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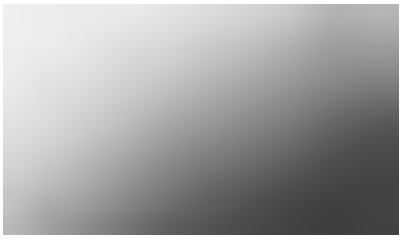

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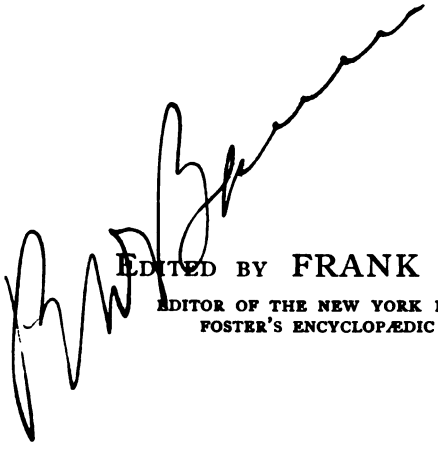

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EDITOR OF THE NEW YORK MEDICAL JOURNAL AND OF FOSTER'S ENCYCLOPÆDIC MEDICAL DICTIONARY

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for the use of narcotics which can not be filled by opium alone; the principal exceptions are delirium tremens, in which chloral is more efficient and safer, and neuralgic affections, spasmodic action generally, and the relaxation of the sphincter muscles, in which belladonna and stramonium are more serviceable. Opium does not produce so much early excitement as alcohol does, though its stimulant stage is well marked, may be maintained by the administration of small doses at proper intervals, and is apparently due to alterations in the relative functions of different parts of the brain. After a full medicinal dose (from 1 to 3 grains) the excitant stage is of shorter duration, and sleep soon comes on, during which external impressions are made with difficulty upon the peripheral nerves or on the organs of sense, are slowly and imperfectly conducted, and are imperfectly perceived by the cerebrum. After a narcotic dose (3 grains or more) the excitant stage is very short; sleep rapidly ensues, becomes deeper and deeper, and passes into coma, from which the patient can no longer be aroused, the strongest external impressions having no influence upon him. This unconscious condition is accompanied by great depression of the medullary centres governing respiration and circulation, the breathing being slow and shallow, the pulse slow and full, becoming very feeble towards the end, the pupils minutely contracted, and the body bathed in a cold sweat. Death occurs by asphyxia, respiration ceasing before the heart stops. Opium has no effect in muscular contractility, and comparatively slight influence on the motor nerves, but it has a marked paralyzing action on the sensory nerves, on the conductivity and reflex function of the spinal cord, and on the cerebral and medullary centres.

Alcohol is primarily an excitant, then an intoxicant, and finally a narcotic. It first stimulates the cerebral circulation, and then proceeds to paralyze the several parts of the brain in the inverse order of their development. This order varies in different individuals, but in all, the powers of judgment and self-restraint are the first to be impaired, as they are the last to be completely developed. Imagination and memory fail next in some cases, while the emotions become prominent; and on this follows disturbance of the power of co-ordination, and soon paresis thereof. In others the latter is impaired to a marked degree before the mental faculties are much affected; the speech becomes thick, and the gait is staggering and uncertain. At this stage reflex action still persists, but afterwards becomes diminished and then abolished. Finally, paralysis of the respiratory centre occurs. The action of alcohol exemplifies three great laws of drug action, viz.: 1. That all stimulation reacts into depression. 2. That most agents which at first stimulate the nerve-centres afterwards depress and finally paralyze them. 3. That when drugs so affect the functions of the body progressively they do so in the inverse order of their development, the highest and latest developed function being affected first, the lowest and oldest last.

Ether, chloroform, and the other general anæsthetics have much the same effects as alcohol.

Chloral hydrate in a large dose (45 grains) causes a deep sleep without preliminary excitement usually, which sleep may pass into coma, with slow respiration, slow and weak pulse, lowered temperature, relaxation of the muscular system, and diminished sensibility and reflex action. By a toxic dose (a drachm or more) all these symptoms are intensified, the coma is profound, the pulse is weak and thready, the pupils are contracted at first, but dilated afterwards, the temperature is greatly lowered, and the patient gradually sinks into death, paralyzed and anæsthetized. Death usually occurs by paralysis of the respiratory centre, but in many cases the cardiac action is simultaneously arrested; and fatal syncope may occur in any case, the heart stopping in diastole from paralysis of the cardiac ganglia.

Bromal hydrate acts in the same way, but is poisonous in smaller doses, and has a more powerful paralyzing action on the heart.

Butyl-chloral hydrate (croton-chloral) also acts in like manner, but much less potently than chloral. The principal symptoms produced by large doses are deep sleep, anæsthesia of the fifth nerve, and death by arrest of respiration; but very large doses paralyze the heart.

Belladonna and its principal alkaloid, *atropine*, also its congeners *stramonium* and *hyoscyamus*, produce active delirium at first, the patient having a constant desire to speak, to move about, or to be doing something, while at the same time he feels great languor; this effect is due to the combined stimulation of the cerebral and spinal nerve-centres and the paralyzing action on the peripheral ends of the motor nerves which is decidedly produced by these agents. Atropine is one of the most powerful of the alkaloids in proportion to its dose, a seven-hundred-thousandth of a grain affecting the pupil (Donders), and a two-hundredth of a grain producing marked physiological effects. Although antagonistic to morphine in most of its earlier actions, its final result is narcotism and death by paralysis of respiration. Hyoscyamus is much feebler than belladonna, but has a similar action, and has been used as a substitute for opium in children and where it is desirable to avoid the constipating action of opium on the bowels. Its derivative alkaloid, *hyoscine*, is a powerful depressant of the respiration in full doses, and efficiently hypnotic and calmative, after a preliminary stage of excitant action, in doses of $\frac{1}{100}$ of a grain, hypodermically.

Cannabis indica is primarily a producer of delirium, and, though its secondary action is of a decided narcotic character, the drug is not dangerous to life, no case of death thereby having ever been known. Some of the phenomena experienced under its influence are of unique character—namely, a sense of double consciousness and a semi-cataleptic state, besides which it produces a considerable degree of anæsthesia and confusion of thought as an after-affect. The dose necessary to produce its full action varies according to the activity of

the preparation and individual susceptibility to it, but may be placed at from 10 to 20 grains of a good alcoholic extract. It loses much of its power by repetition.

Humulus (hops) and *lupulin*, its glandular powder, are feebly narcotic in action, producing such effects only in large doses of active preparations, 2 fl. drachms and upwards of the fluid extract of the former, or a drachm and more of the oleoresin of the latter. Neither drug is capable of producing the extreme stage of narcotism.

Lactucarium (lettuce) was considered highly soporific and narcotic by the ancients, and such qualities were again ascribed to it in the present century by Dr. Coxe, of Philadelphia, and others. It is now looked upon as a very feeble member of the class, if possessing narcotic power at all. The fresh juice of the wild plant was referred to by Dioscorides as nearly equal in power to opium; but there is no case on record of poisoning, or any symptoms approaching it, from any quantity of the modern preparations ever administered.

Carbolic acid is a rapid and powerful narcotic poison, the symptoms developing almost immediately after its ingestion, and death may occur in a very few minutes. The minimum fatal dose is not determined, but ½ an oz. has frequently caused death, which occurs in most cases by paralysis of respiration, in a few by paralysis of the heart, and is preceded by paralysis of motion and sensation, coma, contracted pupils, and abolished reflexes.

Oil of turpentine in a large dose (from ½ to 1 fl. oz.) is a powerful narcotic and excitant of delirium, producing primary symptoms of cerebral intoxication not unlike those of alcohol, followed by paralysis of sensation and abolished reflexes, death occurring in coma or convulsions, or both. In the few fatal cases of turpentine poisoning on record the drug acted evidently through the nervous system, as but slight organic traces of its irritant action were found. The *oils of eucalyptus, rue, savine, tansy*, and *wormwood* have a similar narcotic action in large doses, being powerfully depressing to the brain, medulla oblongata, and spinal cord, abolishing sensation and reflex action, and causing death by paralysis of respiration.

Hydrocyanic acid produces the symptoms of rapid asphyxia, and causes death by cardiac paralysis in the instantaneously fatal cases, by paralysis of the respiratory centre in those which occur more slowly. In the latter, after a convulsive stage, there are coma, complete loss of sensation, paralysis of the voluntary muscles, an almost imperceptible pulse, and slow, weak respiration—the phenomena of narcotic poisoning.

Carbonic acid, nitrous oxide, carburetted hydrogen, and **sulphuretted hydrogen gases** produce symptoms of general narcosis, and cause death by asphyxia from paralysis of the respiratory centre.

SAMUEL O. L. POTTER.

NAREGAMIA ALATA, or *Goa ipecacuanha*, is an East Indian meliaceous shrub said to contain an oil, wax, and the alkaloid *naregamine*. The root is said to be *emetic* and *cholagogue*, and to have been found efficient as a remedy in *indigestion, rheumatism*, and *catarrhal affections*. The powder is given in daily amounts of 16 grains.

NATRIUM.—See SODIUM.

NECTANDRA.—See under BEBEERINE.

NERIUM.—Several species of this echitideous genus of shrubs are reputed to have medicinal properties. *Nerium antidysentericum* is the same as *Wrightia* (or *Holarrhena*) *antidysenterica* (*q. v.*). *Nerium odoratum* (or *odorum*), the *kunarel*, or sweet-scented oleander, of the East Indies, contains two non-nitrogenous glucosides, *neriodorin* and *neriodorein*. *Nerium oleander*, the common oleander, contains two alkaloids—*oleandrine*, bitter and very poisonous, and *pseudocurarine*, tasteless and non-poisonous—also two glucosides, *nerianthin* (an inert substance resembling digitalin chemically) and *neriin*, which, according to Schmiedeberg, seems to be identical with digitalein and to have the same action as that principle upon the heart, causing cessation of its action in systole. Oleander is an active narcotico-acrid poison. It should not be used where there is irritation of the alimentary canal, and the therapeutic employment of it should always be very cautious. It is used as a *cardiac tonic*, and its prolonged use is said to reduce the frequency of the paroxysms of *epilepsy*. There are no official preparations of oleander. The fresh leaves of the Italian plant are preferred in pharmacy. A tincture made with 1 part of the leaves to 5 parts of alcohol may be given in daily amounts of from 5 to 10 drops.

NERVINES.—The nervines include those medicines that are supposed to have a special action on nerve tissue. There are but few agents that act as sedatives or stimulants to the nervous system in virtue of their primary effect on nervous matter. Some medicaments quiet nervous irritability on account of the anodyne influences which they exert. Among these may be mentioned opium, morphine, codeine, chloroform, ether, cannabis indica, belladonna, antipyrine, acetanilide, phenacetine, croton chloral, Hoffman's anodyne, urethane, and many others; some produce a similar result on account of their effect in producing hypnosis, among which may be mentioned sulphonal, chloral, paraldehyde, hypnol, somnal, amylene hydrate, tetronal, trional, chloralose, hydrobromide of hyoscine, and numerous others belonging to this group; some act as stimulants or sedatives, largely through their effect on the circulation, and foremost among these are the organic and inorganic nitrites and nitroglycerin; others have a special influence on the nervous system from their apparent depressive action on the vaso-motor nerves, cimicifuga and calabar bean being the principal ones.

The nervines to which I shall briefly refer in this article are few in number, and consist of asafœtida, the bromides, hydrobromic acid, camphor, monobromated camphor, amber, musk, valerian, hops, sumbul, and strychnine.

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Some of these act as stimulants, some as sedatives, and some as stimulants with a sedative influence on the nervous system, while others apparently influence the nervous system by their tonic action. The bromides constitute the purest type of nervous sedatives. Valerian, hops, and amber are usually considered among the pure nerve sedatives, but it is evident to any one who has carefully studied the influence of these medicaments in quieting nervous disturbances that part of their effect is due to a tonic influence. Asafœtida is usually classed as a stimulant, but it is capable of acting as a sedative in conditions of excessive nervous irritability. Strychnine and sumbul exert their quieting effects on the nervous system in appropriate doses, indirectly through their tonic effect. The rest-cure and forms of hydrotherapy are the best-known non-medicinal means for allaying nervous irritability.

Bromides.—When a purely sedative effect of the bromides is desired they should be given in 10-grain doses, well diluted with water, after each meal, and about double this quantity may with advantage be administered at bedtime. The indications for their use in this manner are found in *nervousness from irritation of the sexual organs*, from *worry*, *cerebral overwork*, and *prolonged mental strain*. Bromide of sodium seems to act better as a pure nerve sedative than most of the other bromides. Hydrobromic acid is more acceptable to the stomach of some patients than the sodium salt, but its influence in producing sedation is usually less apparent.

Asafœtida.—According to my experience, the nervine that stands pre-eminently first in allaying *nervous irritability*, especially in those hysterically inclined, is asafœtida. It apparently acts as a tonic and stimulant, and at the same time has a soothing effect in enabling the patient to suppress excessive nervous manifestations. It has long been to me in the treatment of over-functional nervous manifestations what cannabis indica has proved to be in the treatment of various forms of headache and conditions of hyperalgesia. The only objection to its more frequent use is its excessively offensive odour. I hope to see the time when some enterprising manufacturing chemist will be able to extract a principle from asafœtida that will contain its virtues but not its odour. To obtain the best effect from this drug, it must be given in large doses. Of the gum resin, 3 or 4 pills containing 3 grains each should be given three or four times daily, but most stomachs soon rebel against these large doses. When a speedy action of asafœtida is desired, from 1 to 2 teaspoonfuls of the tincture, in water, may be administered by the stomach, or a tablespoonful by the rectum, in warm milk or water. The drug acts in relieving nervousness, both by its stimulating effects upon the brain and by its lessening intestinal flatulence.

Camphor is employed on account of its supposed sedative action in *nervous manifestations* in women and children, and for its apparent stimulating effect in the depressive stages of the *low fevers*. It has seemed to me to be an agent of uncertain value when used alone for its sedative action on the nervous system, but its influence is undoubted in the treatment of *headaches* and *nervousness from dysmenorrhœa*, when it is combined with some of the analgetics, such as phenacetine or acetanilide. Monobromated camphor combines the effects of the camphor and the bromides, but this is too feeble when used in non-irritating doses to produce a very decided sedative effect on the nervous system. Its best effects are obtained when combined with phenacetine or acetanilide and cannabis indica. Camphorated oil (1 part of camphor to 9 parts of aseptic sweet oil) is a prompt and powerful stimulant, given hypodermically, in cases of *sudden prostration*. The dose for this purpose is 15 minims. When camphor is given in combination with an analgetic, the dose need not exceed from 1 to 2 grains, and monobromated camphor may be administered in about the same doses when used in combination with an analgetic; but when it is employed alone, two or three times these quantities will be necessary to obtain appreciable effects. Both pure camphor and the monobromated, in large doses, are gastric irritants, and should not be given to persons suffering from gastritis.

Valerian is a less reliable agent for the relief of most forms of functional nervous manifestations than asafœtida, but in some cases it seems to be superior to the latter drug. It is not always possible to determine without a trial which will better meet the indications in a given case, but I have thought that valerian is more indicated in *nervousness and hysterical manifestations due to loss of sleep* and *prostration following prolonged periods of uncertainty and intense anxiety*. The best form for administration under such circumstances is the elixir of the valerianate of ammonium in teaspoonful doses every hour or two until relief from the nervous strain is obtained. A hypnotic or a small dose of morphine increases the good effects of the valerian. Valerian in combination with small quantities of morphine acts well in the treatment of *delirium tremens*.

Hops, amber, and **musk** may be classed among the nervines, but their value as nerve sedatives or stimulants is slight, except to meet special indications. Hops, in the form of the hop pillow, have been popularly used to overcome nervousness and induce sleep, but their influence is rather questionable. Lupulin (the powder of the strobiles of the hops), in doses of from 3 to 5 grains, seems to do good in allaying *nervousness from irritation of the urethra*, *bladder*, or *kidneys*. The oil of amber, given in emulsion in from 2- to 5-minim doses, often promptly relieves *hiccough* of functional nervous origin. Musk acts as a temporary, but as an effective and prompt, stimulant in cases of *sudden nervous depression*. It also quiets nervous excitement occurring in depressed states of the nervous system, and is said to be quite effective in relieving *obstinate hiccough* under such circumstances. The dose of the powder is from 5 to 10 grains, by the mouth, in pill, and from 10 to 15 grains, by

the rectum, in starch water; that of the tincture from ½ to 1 teaspoonful. The only occasion for resorting to this expensive medicine is in cases of *great nervous depression*, when tiding the patient over for a few hours offers a "fighting chance" for life. The cost of the pure drug is from twenty to twenty-five cents a grain.

Strychnine and **sumbul** may be classed among the nervines from their special tonic action on the nervous system. Strychnine in small doses has a happy effect in allaying *nervousness* and in enabling the patient to suppress undue nervous manifestations in cases of the functional neuroses. It is an invaluable agent in the treatment of *delirium tremens*. Sumbul, while less efficient than strychnine as a nerve tonic, is a medicine of considerable importance. The indications for its use in the functional neuroses are about the same as those for the use of strychnine, with which it may be advantageously combined in pill or capsule. It often seems to act well in the *unrest of chronic nerve exhaustion* and in the treatment of *delirium tremens*. Of the tincture, the usual dose is from 1 to 4 teaspoonfuls; of the extract, from 1 to 3 grains; and of the powdered root, from 10 to 40 grains.

JEREMIAH T. ESKRIDGE.

NERVOUS SUBSTANCES.—See under ANIMAL EXTRACTS AND JUICES.

NEURODIN. — This is a German trade name for acetylparaoxyphenylurethane,

$$C_6H_4 < \begin{matrix} OCO.CH_3 \\ NH.CO.OC_2H_5 \end{matrix},$$

introduced into medicine in 1893 by J. von Mering, of Halle, as an *antipyretic* and *analgetic*. Lippi (*Policlinico*, Feb. 15, 1895; *Jour. of the Am. Med. Assoc.*, Aug. 17, 1895) has experimented with neurodin on persons free from pain, in order to ascertain the limits of tolerance of the drug and the toxic effects which might be caused by it; also on persons suffering from *pain* of various kinds, either in the form of *neuralgia*, or as symptomatic of organic lesions. He thus treated four cases of *sciatica;* one case of slight attacks of *angina pectoris* in a patient with atheroma of the aorta; one case of *intestinal pain* caused by malignant growth of the retroperitoneal glands; one case of *neuralgia* in a person suffering from polyneuritis; one case of *brachial neuralgia* in a neurotic subject; one case of *gastric pain* caused by epithelioma of the gall bladder; one case of *headache* in a neurotic person who was the subject of a neuralgia simulating polyneuritis; one case of *neuralgia of the bladder* and *stomach* in a patient suffering from cancer of the liver; one case of *muscular pains*, probably rheumatic, in a tuberculous subject; and one case of *pains in the arms* symptomatic of spinal irritation. He found neurodin to have the property of soothing and even abolishing pain, whether neuralgic in character or symptomatic of an organic affection; its action, however, he considers uncertain and notably inferior to that of other similar remedies, such as phenacetine and antipyrine.

Neurodin may be given in wafers, in doses of from 7 to 25 grains. It is said not to be poisonous, although in large doses it has been known to cause diarrhœa.

NICOTIANA, NICOTINE.—See TOBACCO.

NITRATES.—See under NITRIC ACID.

NITRE.—See POTASSIUM NITRATE.

NITRIC ACID, *acidum nitricum* (U. S. Ph., Br. Ph., Ger. Ph.), HNO_3, should be a colourless fluid, but has usually a yellowish tinge, emits white or grayish fumes when exposed to the air, has a very powerful oxidizing action upon nearly all substances, and hence is an active *caustic*. When it comes in contact with organic matter it imparts to it a yellow stain not easily removed. This property is valuable in assisting in a diagnosis of the cause in cases of poisoning by acids, as the mouth and lips are usually of a yellower dark-brown colour. It is not often that accidental or intentional poisoning with it occurs, as the irritating vapours given off by it, except when freely diluted, prevent its being mistaken for other fluids. The treatment differs in no way from that appropriate for poisoning with the other acids, but must be undertaken promptly. As a caustic, it is more largely used than almost any of the other acids, being easy to control and yet sufficiently active to meet the conditions of nearly all cases in which a corrosive effect is desired. It may be applied with a stick, a pledget of cotton, or a glass rod or brush, and its action limited by greasing the parts around the point of application. Weak alkaline solutions may be used to check its action when this has been carried as far as is desired. Freely bleeding *hæmorrhoids*, when of small size, may usually be cured by the free use of this acid. It is applied through an anal speculum, and almost immediately after its application a considerable amount of any vegetable oil should be injected to prevent any extension of its action to the healthy tissues. *Chronic cervical endometritis*, all forms of *intra-uterine granulations*, and *small fibroid tumours* may be benefited by its application, the cervix being thoroughly dilated so as to allow of free access to the interior of the uterus and as clear a view of it as possible. It may also be used to arrest *hæmorrhage* from the mucous membrane of the uterus after operations for the removal of polypi and other small foreign growths. For *phagedænic ulcers*, *chancroids*, *cancrum oris*, and *hospital gangrene* it is the most manageable escharotic in use, although for the last-named condition bromine is to be preferred. *Warts* and *condylomatous growths* may be removed by its aid, and in conditions such as *cancer*, where an operation is inadmissible, it may be used as a palliative. A 2-per-cent. aqueous solution may be employed as a stimulant application to *unhealthy ulcerations* and to bathe *irritated and bleeding hæmorrhoids*. In *chronic cystitis* and *phosphatic deposits in the bladder* it may be used, as a vesical injection, in the proportion of 1 part to 500 parts of water. Baths containing about 1 fl. oz. to

the gallon of water are sometimes employed in the treatment of *cirrhosis* and other chronic affections of the liver, but, while they are of advantage, it is doubtful whether the effect of the acid is anything more than that of an irritant of the skin. Pediluvia of the same strength often relieve the itching of *chilblains*.

When taken internally for any considerable period, nitric acid has an effect upon the gums resembling that of mercury and its salts, but this is probably due to its local action rather than to a constitutional one. This condition should be an indication that its use is to be suspended for a while. Nitric acid may sometimes be substituted for hydrochloric acid when the latter seems to be without avail in the conditions for which it is appropriate. *Oxaluria, dyspepsia with phosphatic urine, summer* and *colliquative diarrhœa, lithæmia, chronic bronchitis,* and *hoarseness* are all conditions in which it may be expected to be of use. Although it has been recommended in the treatment of *intermittent fever*, it is hardly to be relied upon by itself, but is in many instances a valuable adjuvant to quinine, particularly when there are signs of *hepatic engorgement*. There would seem to be little doubt that it is of some value in the treatment of *chronic diseases of the liver*, but nitrohydrochloric acid is more effective. *Whooping-cough*, after the catarrhal symptoms have disappeared, is often benefited by it. In *intestinal indigestion* it is to be preferred to hydrochloric acid when diarrhœa exists, but when it is absent the latter acid is more useful. A number of cures of *constitutional syphilis* treated with this acid alone have been reported, but, as the starvation method has usually been conjoined, it is more than probable that it assisted, as it will in the ordinary methods, rather than acted as a specific.

From 5 to 10 drops of the undiluted acid, in from 3 to 4 oz. of water, may be given three times daily, or even oftener, the usual precautions, such as must be observed in the use of the mineral acids, being taken. The acid of commerce, *acidum nitricum crudum* (Ger. Ph.), is hardly suitable for internal use, as it may contain impurities derived from materials employed in its manufacture, but it may be used externally with entire propriety. The diluted acid, *acidum nitricum dilutum*, of the Br. Ph., contains a little more than 17 per cent. of the strong acid, while that of the U. S. Ph. contains but 10 per cent. The dose of the former is from 10 to 30 drops; that of the latter from 15 to 40 drops, freely diluted with water.

[Fuming nitric acid, *acidum nitricum fumans* (Ger. Ph.), contains nitrous acid and emits a brownish vapour copiously. It is preferred by some practitioners as a caustic.]

The strong acid is very largely used in determining the presence of albumin in the urine. It may be used by placing a small quantity in a test tube and adding cautiously an equal bulk of urine, or by allowing the acid to trickle down the side of a tube into which the urine has been previously introduced, care being observed in each case that the two do not mingle but remain in distinct layers. If the manipulation has been proper and albumin is present, a white ring or disc of the latter will be observed at the point of contact of the two layers, or the acid may be added drop by drop to an indifferent amount of urine in a test tube to the upper portion of which heat has been applied. If albumin is present and has not been previously coagulated by the heat, which it will not have been if the urine is alkaline, a white precipitate or cloudiness is formed. It must be remembered, however, that heat will cause a precipitate of phosphates under certain conditions, but this is redissolved by the acid, which, on the other hand, has no effect upon the coagulated albumin.

[Some of the salts of nitric acid, notably certain organic nitrates, appear to have therapeutical properties that call for some consideration under this heading, principally in the light of Dr. J. B. Bradbury's investigations of the vaso-dilator action of methyl nitrate, glycol (ethylene) dinitrate, glycerol trinitrate (nitroglycerin), erythrol tetranitrate, arabinol pentanitrate, and mannitol hexanitrate, as set forth by him in a Bradshaw Lecture delivered before the Royal College of Physicians of London and published in the *Lancet* and in the *British Medical Journal* for November 16, 1895. All these organic nitrates, says Dr. Bradbury, dilate the blood-vessels, but their activity varies within wide limits, and the variation appears to be due to their different solubilities and liability to decomposition. Methyl nitrate—the most soluble compound—has a comparatively slight vaso-dilating effect. On the other hand, glycol dinitrate—the least stable—has a powerful action closely resembling that of nitroglycerin. Its effect, however, is more transient. The erythrol and mannitol nitrates and the nitrosugars, being less soluble than the other compounds, have a correspondingly weaker effect, but their action is more prolonged. In individual cases slight differences in the extent and duration of action of these bodies are noticed, says Dr. Bradbury, and occasionally persons are met with comparatively insusceptible to their influence. Thus, in some cases of advanced heart disease where the artery presents a feeling of fulness, but yet remains easily compressible (the "virtual tension" of Broadbent), vaso-dilators have often little effect. In these cases the arteries, like the heart, have lost their normal tone, are considerably dilated, and, though possessing a sense of fulness and, on superficial examination, of resistance, are yet arteries of low tension. Coupling with this fact the tendency to fibrous-tissue formation in the various organs in this condition, the author finds some explanation of the comparative irresponsiveness of these cases.

In some cases of not far advanced Bright's disease in which the tension is very high, and is evidently due to causes existent in the blood, a comparatively large dose of nitroglycerin or one of its allies is necessary to produce any marked reduction of tension. "But," says Dr. Bradbury, "apart from such pathological conditions, we now and then come across individuals who can bear large doses of these drugs with impunity. Even in animals there seems

to be considerable variation of susceptibility to the action of vessel-dilating drugs, and particularly of the organic nitrates. The reason is not always clear. Habitual use tends to diminish their action, but this is obviously not the explanation in many cases. With the solid nitrates the amount of food in the alimentary canal at the time of administration, as well as its reaction, will have an important influence in determining the amount of drug dissolved, and therefore absorbed. It may be that under the influence of the alkaline juices of the intestines these nitrates are converted into nitrites (for example, sodium nitrite), but I am rather inclined to believe that this change, if it occurs at all, takes place in the blood or in the cells which form the walls of the blood-vessels." At the time of his lecture Dr. Bradbury knew of only one case—that of a man suffering from dilated heart, the result of alcoholism, in which these drugs had failed to have any distinct effect.

"The action of organic nitrates upon other organs," he continues, "is of little practical importance. Upon the heart the direct effect of these compounds is very slight. Indirectly, owing to the diminished work consequent on dilatation of the blood-vessels, increased rapidity and sometimes palpitation (especially after glycol and glycerol nitrates) are noticed. Certain nervous effects have been attributed to nitroglycerin, but none have, as yet, followed the administration of the solid organic nitrates. The effect upon the urinary excretion is practically *nil*. These bodies, as far as they have been investigated, are not diuretic. As ordinarily administered, the organic nitrates possess no cumulative action. The continued use of nitroglycerin produces a lessened susceptibility to its effects, but this has not yet been noticed after the administration of the erythrol and mannitol compounds."

Reviewing the action of these compounds upon the vascular system in regard to their practical application to the treatment of disease, Dr. Bradbury thinks we may, for the present at least, discard methyl nitrate as being the least likely to prove of clinical value. Glycol dinitrate, again, is so similar in action to nitroglycerin and, at the same time, so much more expensive, that it also is not likely to enter into our stock of remedies. The longer-acting nitrates, however, may prove of value.

Dr. Bradbury continued as follows: "From the pharmacological action of these two nitrates, it would seem that the chief indication for their use is a condition in which the heart is labouring under increased work imposed upon it by contracted arteries. As life advances, the hitherto elastic vessels become converted into more or less rigid tubes, the fibrous adventitia is thickened, and fibrous tissue replaces, to a greater or less extent, the muscular and elastic tissue of the middle coat. As a result, increased work is put upon the heart, and hypertrophy results. Sooner or later, however, central or peripheral degeneration occurs; either the heart fails from the increased strain put upon it on the one hand, or causes rupture of a vessel from excessive power on the other. In disease the normal evolution may be compressed into a much shorter space of time; thickened arteries and hypertrophied hearts may be found comparatively early in life; and the final results may be the same. If by any means we can dilate the vessels we diminish the work of the heart and the pressure upon each unit of area of the artery, and thus in both ways avert the tendency to death. Our difficulty hitherto has been, not so much to reduce arterial tension when desired as to keep the tension steadily below a certain level. Both nitroglycerin and sodium nitrite have been used for this purpose, but their administration is attended with some inconvenience. As we have seen, these drugs have comparatively little action after two hours, and it would therefore be necessary to give them at least every two hours to produce continuous low tension. Even then there would be considerable variation in the arterial pressure. By the substances I have described the tension is not brought so low, but the reduction is of longer duration and the pressure is less liable to fluctuation. They are also, as far as I am aware, free from poisonous properties, a quality readily explained by their slight solubility."

In *cardiac pain*, under which name he includes all forms of pain accompanying diseases of the heart or vessels, and adopts it in preference to *angina pectoris*. Dr. Bradbury thinks that obvious increase of tension is not always present. In a heart weakened by disease, he remarks, a very slight increase of resistance may prove too much for the heart to overcome. This slight increase may be due to a general effect almost inappreciable in any one artery, or to an effect localized in one or more areas. Of greater significance is the fact that vaso-dilators do not always relieve angina-like pains, especially if these occur in cases of far-advanced heart disease with a low-tension pulse. In such cases morphine is of much greater value.

It is only, he says, by keeping arterial pressure below its normal level that the solid organic nitrates can be of service in the prevention of a seizure. "When an attack has come on," he says, "it is necessary to resort to more quickly acting drugs, and in cases of a sudden and severe nature inhalation of the fatty nitrites is advisable. For cases in which the pain is less severe and of longer duration the administration of nitroglycerin or sodium nitrite is perhaps more beneficial. But if we can prevent the advent of these attacks, a great stride ahead will have been made. Much may be done by the exhibition of purgatives and attention to the general health, but in the majority of instances something more is needed. This something is, I believe, a vaso-dilator. Hitherto nitroglycerin and sodium nitrite have been the drugs mainly used; but their evanescent and varying action render them unsuitable. Nevertheless, I have seen cases in which the continuous administration both of nitroglycerin and sodium nitrite seemed to prevent the occurrence of anginal attacks, and other physicians have reported similar results. In

many of these cases, however, attacks occasionally developed, and it is quite possible that longer acting remedies, such as erythrol nitrate, might have prevented them altogether."

In regard to *chronic Bright's disease*, Dr. Bradbury says: "The most important change, and the one which affects us most closely, is the arterial thickening attending Bright's disease. This leads to hypertrophy of the heart, and both combined to a high-tension pulse. Sooner or later, if the patient does not succumb to uræmia or some intercurrent disease, the increased vascular strain begins to tell either upon the heart or on the vessels, often on both. Either the symptoms of heart failure develop or attacks of apoplexy occur. Previous to such terminations, headache, mental inaptitude, weariness, and similar symptoms are not uncommon, and sometimes these may be noticed, with a high-tension pulse, where no other direct evidence of renal disease exists. In all such cases the longer acting vaso-dilators are often beneficial. I do not wish to convey the impression that I regard the thickened condition of the arteries as the primary cause of the high tension of Bright's disease. This, I believe, is due in the first instance to an impure condition of the blood, and the correct treatment under the circumstances is to rid the blood as far as possible of this impurity. Once, however, the fibroid and muscular thickening in the arteries is produced it becomes a danger in itself. It is a condition we can not cure, and our treatment must therefore be symptomatic. By keeping down the arterial pressure in such conditions we may not only alleviate unpleasant symptoms, but may also prevent the onset of such disastrous conditions as cerebral hæmorrhage. The fibroid thickening of the blood-vessels does not annul the action of these nitrates, though it diminishes to some extent their power." Tracings were shown, one series of which had been taken from a man in advanced Bright's disease; the other from a man who had had slight attacks of cerebral hæmorrhage. With regard to the action of these drugs upon the kidney disease itself, the author did not expect any beneficial action. "They are not diuretic," he said, "at the same time they are not irritant to the kidneys, and, given even in acute inflammatory conditions of these organs, are not likely to produce ill effects."

In cases of *aneurysm*—meaning those coming under the care of the physician—Dr. Bradbury says it is very necessary to keep the circulatory system as far as possible in a state of physiological rest. This is best accomplished by dilating the peripheral arteries, and for this purpose iodide of potassium has for some time been the drug most in vogue. Without detracting in the least from the value of potassium iodide in this condition, he thinks that the nitrate of erythrol or of mannitol will accomplish this end better, and will give more satisfactory results, in cases not of syphilitic origin. The pain which accompanies aneurysm is not often relieved by vaso-dilators, and therefore he does not expect any benefit from the nitrates in such cases.

Of other conditions connected with the contraction of blood-vessels, *Raynaud's disease*, says Dr. Bradbury, is one that has been successfully treated with nitroglycerin. If vaso-dilators are of value in this condition, it seems to him that erythrol nitrate, as tending to keep up a more constant dilatation, would be of greater value.

With regard to respiratory conditions, he does not expect any beneficial effects from these bodies. In various forms of *dyspnœa* (uræmic, asthmatic, and bronchitic) nitroglycerin and the nitrites are sometimes of value, he remarks, but they often fail to relieve. Seeing, then, that the action of these comparatively powerful vaso-dilators is not very distinct, he says, we should not expect the less powerful drugs mentioned to exercise much influence. They may prove of prophylactic value in the dyspnœa occurring in Bright's disease, for example, but beyond that it would be useless to hazard conjectures. In cases of *chronic bronchitis*, however, and in other conditions where the dyspnœa is of cardiac origin, amelioration might be obtained from these compounds, he thinks. In such cases the weak heart is unable to drive the blood with sufficient power along the arteries; stagnation therefore occurs in the veins, and the pulmonary system is often the first to suffer. Thus aeration is limited by the pulmonary lesions on the one hand and the cardiac on the other. By dilating the vessels and thus relieving the heart, the circulation becomes more efficient and the blood is better aerated; but under such conditions digitalis is usually of much greater benefit. He mentions that disappearance of the headache occurring in a chronic bronchitic, with full, rather tense pulse, followed the administration of erythrol nitrate.

It is very probable, he thinks, that *anæmic headaches* occurring in patients with a high-tension pulse may be relieved by this drug, but his observations on this condition have been confined to those with a low-tension pulse, and the results have been somewhat conflicting.

Although nitroglycerin has been given in many *nervous affections*, Dr. Bradbury does not think much benefit will follow the use of erythrol or mannitol nitrate in these diseases. *Migraine* and *neuralgia*, he remarks, are often accompanied by reflex contraction of the blood-vessels, and the use of vaso-dilators has sometimes proved curative. The solid organic nitrates, however, are, he says, much too slow in action to be of benefit, though it is possible they may prevent attacks of migraine if administered continuously. The drugs might also be used by those who believe in the value of nitroglycerin in *epilepsy*, but as he has rarely used this drug in this affection, his experience on this point is limited. Other nervous diseases — *epileptic vertigo*, *cerebral congestion*, *tetanus*, etc.—in which nitroglycerin has been used are not likely, he thinks, to yield to treatment with the nitrates.

The dose of the solid organic nitrates, according to Dr. Bradbury, may be taken as 1 grain; more may be given if it is thought

necessary, but usually this amount will suffice. They may be taken in the form of pills or tablets or in alcoholic solution. The last method he prefers. A solution of erythrol nitrate in the strength of 1 in 60 may be made, and 1 fl. drachm may be taken in an ounce of water when necessary. Mannitol nitrate, he says, is not quite so soluble, but a 1-per-cent. alcoholic solution can be prepared, of which 1½ or 2 fl. drachms may be taken in water. The additions thus made are stable and free from irritating properties.

He knows of no evil effects having followed the administration of these drugs, but he adds that his investigation of them is not yet complete.]—RUSSELL H. NEVINS.

NITRITES.—The compounds known as the nitrites have become quite numerous. They may be divided into two groups—the inorganic and the organic. Those constituting the former group are less numerous than those of the latter. The nitrites of sodium, barium, calcium, potassium, and strontium are the principal ones whose bases are of mineral origin. The organic nitrites whose properties have been most extensively studied are compounds of methyl, ethyl, propyl, butyl, and amyl. From these we have the primary, iso-primary, secondary, and tertiary nitrites. "The primary nitrites, both normal and iso-primary, differ from the secondary and tertiary compounds in containing nitroxyl joined to a methylene group (CH_2), and all these primary compounds therefore contain the complex (CH_2NO_2) united with the different alkyl radicles. In the secondary nitrites one atom of hydrogen in this group is replaced by methyl, $(CH_3)CH(CH_3)NO_2$, while in the tertiary nitrites both the hydrogen atoms are replaced by methyl, and these bodies therefore contain the group $C(CH_3)_2NO_2$. If the radicle takes the place of hydrogen in one of the methylene groups, but not in that which is attached to nitroxyl, the iso-primary butyl nitrite is formed" (Cash and Dunstan, *Phil. Trans. of the Roy. Soc. of London*, vol. clxxxiv [1893], B, pp. 505–639). Thus, of butyl we find normal (primary), iso-primary, secondary, and tertiary nitrites. Nitroglycerin is sometimes erroneously regarded as a nitrite. It is a trinitrite of glyceryl. (See NITROGLYCERIN.)

The influence of the nitrites on the general circulation is to lower the arterial tension and increase the rapidity of the pulse, with flushing of the face, the neck, and the upper portion of the chest, especially pronounced from the influence of the amyl nitrites. The dilatation of the capillaries of the skin over the other portions of the body is not often very marked. It has been demonstrated that the arterioles of the lungs dilate from the influence of these agents, thus pointing to their usefulness in relieving a distended right heart. The lowered arterial tension is mainly due to the direct effects of the nitrites in paralyzing the circular muscular fibres of the arterioles, and the increased rapidity of the heart's action probably results from their depressing influence on the inhibitory nerve of the heart and the impression made upon the cardiac muscle by the sudden dilatation of the arterioles. According to the observations of Professor Cash and Professor Dunstan, the nitrites named below accelerate the pulse in the following order, the strongest being named first: Tertiary amyl nitrite, α-amyl nitrite, β-amyl nitrite, tertiary butyl nitrite, isobutyl nitrite, secondary butyl nitrite, butyl nitrite, secondary propyl nitrite, primary propyl nitrite, ethyl nitrite, and methyl nitrite. The pulse begins to show some acceleration at the end of five seconds after inhaling a few drops of amyl nitrite, attains the greatest frequency about the end of the 35th second, when it begins gradually to decline, and reaches normal at the end of the 70th to the 90th second. The average greatest frequency from moderate doses of the amyl-nitrite preparations is from 30 to 40 beats a minute. The primary butyl nitrite causes about 75 per cent. of the pulse acceleration found to follow amyl nitrite. The greatest frequency of the pulse is reached between 25 and 28 seconds after beginning the inhalation, and the return to normal is a few seconds (3 to 5) sooner than follows after inhaling amyl nitrite. Isobutyl and secondary butyl nitrites increase the pulse a little more than primary butyl nitrite. Isobutyl nitrite causes about 82 per cent. and the secondary about 80 per cent. of that found to follow the inhalation of an equal quantity of amyl nitrite. The pulse after each returns to normal a few seconds sooner than after amyl nitrite. Primary propyl nitrite accelerates the pulse about 62 per cent. and the secondary about 76 per cent. of what results from an equal dose of amyl nitrite. The acceleration and reduction of the pulse are effected in a shorter time than from amyl nitrite. Ethyl nitrite increases the pulse-rate only 10 or 15 beats a minute. The maximum influence on the pulse is reached about 25 or 30 seconds after inhalation is begun, but complete reduction does not take place until at the end of the 60th or 70th second, when the pulse shows a tendency to fall below normal (Cash and Dunstan). Professor Leech's experiments (*Brit. Med. Jour.*, July 1, 1893, p. 6) show a slower action of ethyl nitrite than that observed by Cash and Dunstan. Sodium nitrite acts much more slowly than the group of organic nitrites, and its influence is much more prolonged.

There is no positive evidence of the nitrites having a direct stimulating effect upon the heart. In large doses they all lessen the strength of the cardiac systole, and especially is this effect well marked after large doses of sodium and ethyl nitrite. Leech, in comparing the influence of the nitrites with that of alcohol, says: "On the whole, it seems to me we must accord to the nitrites in small doses a certain degree of that kind of stimulating power which we attribute to alcohol, but it is exercised much more quickly, passes away more rapidly, and is far more readily followed by decreased cardiac power than is alcohol." By relieving the distended right heart of blood and depressing the cardiac inhibitory centres the nitrites act as indirect cardiac stimulants. Irregular action of the heart may result from

large doses of the nitrites, and slight irregularity is said to be common after the inhalation of amyl, isobutyl, and propyl nitrites. The recorded observations of a number of clinicians are to the effect that previous irregular action of the heart is no bar to the administration of the nitrites, and that when such irregularity exists it is frequently lessened, sometimes made to disappear, and rarely increased by appropriate doses.

Reduction of the Blood-pressure.—Reduction of the blood-pressure is usually well marked after the administration of the nitrites. According to Cash and Dunstan, the organic nitrites may be arranged as follows, the numerals representing the relative strength of each in reducing the blood-pressure: The tertiary nitrites—butyl (9), amyl (6): the secondary—propyl (10), butyl (8); the primary—iso-butyl (7), amyl (5), methyl (4), butyl (3), ethyl (2), and propyl (1).

Respiration.—Very small quantities of the nitrite do not perceptibly affect respiration; medicinal doses increase the number of respirations to the minute, the increase amounting in the case of the primary amyl nitrite to 5 or 9, and occasionally to 12 respirations over the normal. Repeated inhalations without a long interval cause distinct slowing of the respiration. Toxic doses paralyze respiration before the heart ceases to beat. Leech believes that small medicinal quantities of the nitrites stimulate the respiratory centre. When these agents exert a depressing effect on the respiratory centre it is probably through their influence on the blood, which becomes dark, and even chocolate-coloured, before death, from interference with hæmic respiration.

Stomach and Bowels.—The effect of the nitrites on the gastro-intestinal mucous membrane varies in different individuals. Many experience no inconvenience when the nitrites are administered in medicinal doses beyond emanations of nitrous gas in small quantities, especially following the ingestion of sodium and ethyl nitrites, while to others they act as gastric irritants, causing sickness and diarrhœa. Leech thinks that when inhalation of the nitrites causes gastro-intestinal disturbance it is due to their excretion by the stomach and bowels.

Kidneys—Dilatation of the vessels of the kidneys results from the administration of the nitrites, and an increased flow of urine takes place in some cases, but experimental observations seem to show that they are rather unreliable diuretics. Atkinson found in carefully conducted experiments on lower animals that small doses of nitrite of sodium either did not affect the flow of urine at all, or slightly diminished or increased it. Leech's experimental observations on twelve persons free from fever, cardiac or kidney disease, to each of whom he gave 3 grains of nitrite of sodium thrice daily for a week, showed the urine increased in quantity in seven and decreased in five. In only one of the seven was the urine markedly increased, amounting in this one to 217·721 c. c. (7 fl. oz.) daily (*Brit. Med. Jour.*, July 1, 1893, p. 7). The excretion of urea and that of uric acid seem to be unaffected by the use of the nitrites. It should be remembered, as Leech reminds us, that, although the nitrites do not materially affect the action of the kidneys in health, it does not follow that they are inert in certain pathological states of these organs.

Temperature.—Small quantities of the nitrites, given to persons in health, do not materially affect the temperature, but in toxic doses they lower it considerably.

Perspiration.—Most nitrites, when given in sufficiently large doses to dilate the vessels of the surface of the body, will increase the perspiration temporarily. Both sodium and ethyl nitrite possess this power in conditions favourable for their action. The latter, in the form of spirit of nitrous ether, given in doses of ½ a fl. oz. in hot drinks, is the most reliable, but little effect may be expected from it when given in doses varying from 10 to 15 minims. The condition most favourable for the diaphoretic action of the nitrites is a febrile condition following exposure to cold.

The Nervous System.—The nitrites in ordinary medicinal doses do not seem to depress the nerve-centres or nerves, but in large therapeutic and toxic doses they lessen cerebral activity, giving rise to heaviness and apathy, and sometimes even to stupor or unconsciousness after inhalations of large quantities of the vapour of nitrous ether or nitrite of amyl. Leech is confident that no narcotic effect need be feared from the use of the nitrites in medicinal doses, and observes that "the sense of distention and throbbing in the head, the dizziness, and the headache felt by some after amyl, ethyl, or sodium nitrite are manifestly due to circulatory changes; but the prolonged headache, which does not always come on immediately, but may last for twelve hours or more after some nitrites have been taken, is probably not due to the same cause. It is most frequent after amyl and isobutyl compounds. I have felt it myself after both, and also after propyl compounds, but not after ethyl nitrite or sodium nitrite. I am inclined to think it is caused by the alcohol radicles, and not by the nitrite element, for other amyl, isobutyl, and propyl compounds produce the same kind of long-lasting headache." The convulsions that sometimes occur in the lower animals and the slight muscular twitching that has been occasionally observed in man, after taking large doses of one of the nitrites, especially the amyl nitrite, are thought to be of cerebral origin and due to the asphyxiating influence of the poison. All observers seem agreed that the entire absence of any serious or fatal brain disturbance following large doses of the nitrites makes the unpleasant cerebral symptoms no bar to their administration in medicinal doses. Motor conduction and the reflex activity of the spinal cord are depressed after toxic quantities of the nitrites in the lower animals, and probably also in man, even after very large medicinal doses, but other symptoms than spinal are so prominent after using these agents in man that it is almost impossible to determine satisfactorily their effects on the functions of the cord. The activity of the motor nerves is undoubtedly

lessened, but not out of proportion to the irritability of the muscles. The sensory nerves do not seem to be directly affected, and the relief of pain which sometimes follows the use of the nitrites is due to their influence on the circulation.

Therapeutic Uses of the Nitrites.—The carefully conducted experiments of Professor Reichert (*Am. Jour. of the Med. Sci.*, July, 1880, p. 158) show that the physiological effects of the alkaline nitrites, especially of sodium and potassium, are almost identical with those of amyl nitrite, except that they are much slower in their action and more permanent in their effects. The investigations of Cash and Dunstan (*l. c.*) demonstrated a marked similarity between the effects of amyl nitrite and the other organic nitrites. And, finally, the admirable clinical observations of Professor Leech (*Brit. Med. Jour.*, vols. i and ii, 1893), as well as the experience of various clinicians, enable us to conclude that the therapeutic indications whose value has been determined are nearly the same, and the choice of the nitrite to be employed in a given case will depend largely upon the rapidity of action and the permanence of the effects desired from a nitrite, modified by the unpleasant symptoms which are more likely to follow the use of certain nitrites than of others. The reader is referred to the article on AMYL NITRITE for the general therapeutic indications of the nitrites.

[Petrone (*Riforma med.*, Aug. 31, 1895; *Brit. Med. Jour.* [*Epitome*], Nov. 23, 1895), having found that rabbits that had been inoculated subdurally with rabies had their period of survival doubled by subcutaneous injections of sodium nitrite, tried the same treatment in two cases of *syphilis* with good results. The first case was that of a man suffering from marked malarial cachexia and enlarged spleen, who contracted syphilis in December, 1893. During the early manifestations he took mercury and iodide of potassium, but as soon as the symptoms disappeared he ceased taking medicine. In March, 1894, he suffered from marked nocturnal osteocopic pains, periostitis of the skull and tibia, and an abundant papulopustular syphilide. From 5 to 10 grains of sodium nitrite, rapidly increased to 50 grains, were injected daily in two doses. The nocturnal pains were relieved on the second day, and the rash and periostitis gradually disappeared, so that at the end of a month the patient was able to work and in much better health in every way. The second case was that of a woman, aged twenty-two, suffering from hereditary syphilis, which had first developed ten years before, and been treated with potassium iodide and mercury. In April, 1895, she presented loss of bony substance over an area equal in size to a 5-franc piece on the right frontal bone and on the left parietal, confluent ulcerating gummata on the back, gummata on the thigh, and very extensive ulceration of the leg. The daily injection of 50 grains of sodium nitrite in two doses was practised, and the ulcers were merely cleansed with boric-acid solution. After twenty-six days the sores were almost all healed. The treatment was then interrupted for a few days by an attack of acute bronchitis. On the resumption of the injections the patient was cured in ten days more and her general health much improved. No local troubles or general symptoms followed the injections. The solutions, says the author, should not be more concentrated than 2 or 3 per cent.]

Some of the Nitrites Compared.—Headache is more common after the amyl, isobutyl, and propyl compounds, and least frequent after the nitrites of sodium and ethyl. The pulse is most accelerated by the amyl nitrites, but sodium and ethyl nitrites cause only slight increased action. Gastric irritation occasionally follows the use of nitrites of sodium, potassium, and ethyl. When rapidity of action is desired, nitrite of amyl is to be preferred to all the other nitrites, but if a more prolonged influence of a nitrite is the object, nitrite of sodium is preferable. Cash found isobutyl and secondary propyl compounds most active in lowering blood-pressure, and Leech thinks that isobutyl nitrite is more reliable for the relief of *anginal pain* than the official amyl nitrite. In cases where it is desirable to increase the flow of urine temporarily, ethyl nitrite or the spirit of nitrous ether is fairly efficient, if given in sufficiently large quantities.

Dose and Administration.—Half a fl. oz. of spirit of nitrous ether, or 1 fl. drachm of the 2·5-per-cent. solution of the nitrite of ethyl, should be given to an adult. The former contains, when pure, from 2·5 to 2·75 per cent. of nitrite of ethyl. It should not be mixed with water except in combination with an alkaline solution, such as the acetate of ammonium or potassium, until just before administration, as it rapidly deteriorates after water has been added. The nitrite of ethyl is soluble in absolute alcohol, and must not be mixed with water until the time of its administration. Of the two alkaline preparations (of sodium and potassium) of which most is known, the nitrite of sodium is most commonly employed when a prolonged effect of a nitrite is desired. The sodium and potassium nitrites may be given in doses varying from 1 to 5 grains. Two grains is the ordinary dose to begin with, but it is always safe to begin with the minimum dose of a medicine that is sometimes followed by unpleasant symptoms, and increase the quantity after the susceptibility of the patient is ascertained. The nitrite of sodium or potassium may be given in water. When it is desirable to administer a nitrite hypodermically, a solution of nitroglycerin, which acts like a nitrite, is to be preferred to the nitrite of sodium or potassium. (See NITROGLYCERIN.)

JEREMIAH T. ESKRIDGE.

NITROBENZENE, or *nitrobenzol*, $C_6H_5NO_2$, oil of mirbane, artificial oil of bitter almonds, is an oily liquid that has an odour resembling that of bitter almonds, and a very sweet taste. It is produced by the action of strong nitric acid on benzol, the resulting product being washed with water.

If nitrobenzene is injected into the blood-vessels of a rabbit, death with convulsions en-

sues in a few seconds. Administered internally to an animal, it produces unconsciousness, epileptoid spasms, in some animals glycosuria, and sometimes death in consequence of paralysis of the motor-centres of the nervous system.

The inhalation of the fumes of nitrobenzene produces in man headache, muscular weakness, drowsiness, mental disturbance, and a blue colour of the face. Taken internally, the drug is absorbed more or less slowly, and, in addition to the foregoing symptoms, the entire body acquires the bluish colour, the pupils are dilated, the respiration is rapid, shallow, and irregular, the pulse is rapid and thready, soon becoming imperceptible, the muscles are completely relaxed, and consciousness is lost. Fifteen drops have caused death.

Nitrobenzene has no therapeutic uses, but is employed in manufactures. In case of poisoning with it, apomorphine or some other emetic should be administered at once so as to empty the stomach, which should be washed out by means of a stomach-pump or stomach-tube; hypodermic injections of strychnine should be administered as may be necessary; the bodily temperature should be maintained with hot-water bottles or bags; and massage and artificial respiration should be used if necessary.

SAMUEL T. ARMSTRONG.

NITROGEN, *nitrogenium*, or *azote*.—This gas is disengaged freely from certain mineral waters, such as those of Lippspringe and the Ottilien-Quelle at Paderborn. According to Dr. I. Burney Yeo (*Manual of Medical Treatment*, Philadelphia, 1893), the gases that those waters give off contain respectively 83·25 and 97 per cent. of nitrogen. Great improvement of the *general* symptoms in cases of *pulmonary tuberculosis*, says Dr. Yeo, is stated to follow the inhalation of this gas, which is conducted with the aid of a special apparatus: the sleep is said to become calm, the appetite to increase, the night sweats to diminish, the diarrhœa, if there has been any, to be allayed, and the pulmonary capacity, the weight, and, except in desperate cases, the bodily strength and activity to be increased. But the fever has been reported as variously influenced. Treutler (Oertel's *Respiratory Therapeutics*, Yeo's translation) says: "In slighter cases it soon disappeared, in others it was sometimes even exaggerated for the first week or two, afterward diminishing somewhat rapidly or ceasing altogether, while in hopeless cases it was unaffected."

Dr. Yeo refers to Oertel's book for a full description of the mode of conducting the inhalations, and makes the following quotation from his translation of it: "It is difficult as yet to express a decided opinion on the influence of nitrogen inhalations on chronic pulmonary infiltrations, as we have not nearly sufficient observations on the subject to exclude completely all the casualties which always occur in the treatment of pathological processes running so varied a course, and to be able to separate the influence of the various other agents which come into operation. For the present it behooves us to give a fair trial of nitrogen inhalations in the treatment of *chronic pneumonia* and its products."

On the other hand, Rhoden, of Lippspringe (cited by Yeo), is inclined to attribute the good effects of the treatment to the moist climate, the inhalation of vapour of water, and the drinking of a great amount of warm water containing a considerable quantity of calcium salts, together with a little sodium sulphate, the patient fasting.

NITROGLYCERIN, an organic nitrate, glyceryl trinitrate, $C_3H_5(ONO_2)_3$, is an explosive compound, and to obviate the prejudice that some patients might therefore have against its use, it has been employed under the names of *trinitrin* and *glonoin*. It is an agent of considerable importance and is principally used in medicine when it is desirable to make a rapid and powerful effect upon the vascular apparatus by dilating the arterioles. It occupies a place between amyl nitrite and sodium nitrite, being less rapid in its action and more permanent in its effects than the former, but expending its influence on the vascular system more quickly than the latter, although the headache which is very common after a large dose of nitroglycerin persists much longer than one produced by sodium nitrite.

The effects of nitroglycerin are first experienced by the patient in from a few seconds to one or two minutes after the drug has been administered. In small doses, yet large enough to be appreciable, these consist of full and throbbing sensations in the head and slight dizziness, followed, in some instances, by headache. Larger medicinal doses give rise to suddenly developed dizziness, full, throbbing, and constricting feelings in the head, amounting frequently to decided headache; a choking sensation in the throat, at times nausea, faintness, rapid action of the heart, lessened arterial pressure, dilatation of the arterioles, followed by languor, and, according to Bartholow, sometimes pains in the stomach. In still larger, or lethal doses, the effects are rapidly developed and very pronounced, amounting to an extreme degree of languor and muscular relaxation, weak and rapid action of the heart, small, feeble, or imperceptible pulse, cold, clammy perspiration, and even unconsciousness. The effects of nitroglycerin are most rapidly developed when it is administered in alcoholic solution.

On account of the variable susceptibility exhibited by different persons to the influence of this medicament, considerable care is required that the initial dose should not be larger than is necessary to produce the desired results. One minim of a 1-per-cent. alcoholic solution has produced insensibility, and 2 minims have been followed by loss of consciousness and absence of the pulse at the wrists (H. C. Wood, *Therapeutics and Materia Medica*, 6th ed., p. 390). I have observed unpleasant effects to follow the use of $\frac{1}{100}$ of a grain. On the other hand, some persons experience no disagreeable symptoms after taking 2 or 3 minims of a 1-per-cent. solution. Persons soon become accustomed to increasing doses of

nitroglycerin. Dr. Murrell gave 10 minims eight times daily, the only effect being to relieve anginal pain and cause some headache (Croonian Lectures, *Brit. Med. Jour.*, July 8, 1893, p. 57). Bartholow thinks that women and persons of feeble constitution are more susceptible to the drug under consideration than the robust (*Materia Medica and Therapeutics*, 8th ed., p. 667). Like nitrite of amyl, nitroglycerin, in toxic doses, causes the blood to assume a chocolate colour, owing, no doubt, to its power of interfering with hæmic respiration.

Death may be produced by large doses of nitroglycerin, and such a result is apparently due to paralysis of the muscles of respiration; but if ordinary care is used in the employment of this powerful agent, nothing further than slight inconvenience will be encountered in those who are the most susceptible to its influence. Even when unconsciousness has been produced by its too free use, recovery has taken place without an untoward symptom beyond headache that persisted for some hours.

Dose and administration.—It is always safer to begin with a small dose in persons whose susceptibility to the influence of nitroglycerin is unknown, and rapidly increase the quantity until slight inconvenience is experienced by the patient, or the desired results are obtained. The initial dose for weak and nervous persons should not exceed $\frac{1}{100}$ or $\frac{1}{200}$ of a grain, and if no appreciable effects are experienced the same quantity may be repeated in ten minutes. If still no effects are observed, the dose may be doubled and repeated as often as is found necessary. There are two solutions of nitroglycerin in use—the alcoholic, *spiritus glonoini* (U. S. Ph.), and the aqueous. They are both 1-per-cent. solutions. The alcoholic solution is more reliable than the aqueous, but the disadvantage of it is that it becomes explosive in proportion to the amount of evaporation that has taken place of the alcohol holding it in solution. Hare recommends that it should be kept in tightly stoppered tins, in a cool place. The dose to begin with of either of these solutions should not exceed $\frac{1}{2}$ a minim in persons whose susceptibility to nitroglycerin is not known. Tablets and pellets of nitroglycerin are made by manufacturing chemists. The amount of nitroglycerin contained in them varies from $\frac{1}{200}$ to $\frac{1}{100}$ of a grain. I have known the weaker ones to cause unpleasant symptoms.

[The British official tablets, *tabellæ nitroglycerini* (Br. Ph.), are tablets of chocolate, each containing $\frac{1}{100}$ of a grain of pure nitroglycerin.]

To Dr. Murrell, of London, belongs the credit of having first employed nitroglycerin for the relief of spasmodic attacks of *angina pectoris*. It seems to lessen or cut short the precordial pain and distress by suddenly dilating the arterioles, especially of the pulmonary circulation, and thus relieving the distended cavities of the heart. When great promptness of action is required, inhalations of amyl nitrite should be given for its temporary effect, followed by nitroglycerin for its more permanent influence. As soon as the susceptibility of the patient to the influence of this drug is ascertained it must be pushed to the point of tolerance. Larger doses are required in this disease than in almost any other spasmodic affection. Leech (*Brit. Med. Jour.*, July 15, 1893, p. 109) states that he has had to gradually raise the dose to 20 minims, and a larger dose is frequently required.

The nitrites generally, and nitroglycerin especially, are useful in *cardiac dyspnœa*, both of pulmonary and of cardiac origin. In cases in which the heart is weak or fatty, it is thought care should be exercised lest damage to the heart result, but, on the whole, the weight of testimony is in favour of the use of this agent, even under such circumstances.

Some cases of *spasmodic asthma* are benefited by nitroglycerin, but in this affection, as in angina pectoris, the less the structural changes that have taken place, the better the effects of the nitrites; therefore it is in the early stages of these diseases that most may be expected from the use of any of the nitrite group.

It is well known that the arterial tension is increased in *Bright's disease*, and, as nitroglycerin lessens this, it, as well as the other nitrites, has been employed with, as is alleged, more or less advantage to the patient (Bartholow, Robson, *et al.*).

Nitroglycerin has been employed with some success in *hiccough*, *whooping-cough*, *laryngismus stridulus*, *tetanus*, *seasickness*, *reflex vomiting*, *gastralgia*, and *hepatic* and *renal colic*. It is not so effectual in preventing an attack of *epilepsy* as amyl nitrite. In *migraine* attended with blanching of the face, and in *neuralgia of the trigeminal nerve* due to insufficient blood supply to the affected nerve nitroglycerin acts promptly in cutting short an attack. *Headaches due to anæmia of the brain* are relieved by this agent. Bartholow speaks highly of the use of nitroglycerin in the cure of *anæmia*. The *cold stage of intermittent fever* may be aborted by any of the promptly-acting nitrites. Gowers recommends the use of nitroglycerin thrice daily in persons who are subject to *migrainous headaches*, given during the interval of the attack for the purpose of increasing the blood supply of the brain.

[Nitroglycerin has recently been found a very potent remedy in *sciatica*. A Russian physician, Dr. Milkhalkine (*Semaine méd.*; *Lyon méd.*, Feb. 24, 1895), reports three cases of persistent sciatica that had been absolutely rebellious to the action of antipyrine, of acetanilide, of chloral hydrate, of the bromides, and of other analogous drugs, as well as to the employment of revulsives. Under the influence of nitroglycerin two of the patients were radically cured of their sciatica, and in the third case it produced a considerable amelioration. It was administered sometimes in a 1-per-cent. alcoholic solution, of which three drops a day were taken, sometimes under the form of the following mixture:

A 1-per-cent. alcoholic solution of nitroglycerin, 75 grains;
Tincture of capsicum, 113 grains;
Distilled peppermint-water, 225 grains.
S.: From 5 to 10 drops three times a day.

Dr. William C. Krauss, of Buffalo (*N. Y. Med. Jour.*, Feb. 29, 1896), before he had seen Milkhalkine's report, and having only a vague knowledge that Lawrence had recommended the use of nitroglycerin in the treatment of sciatica, treated seven cases with the drug, using it indiscriminately in all his cases of sciatic pain. Dr. Krauss reports that all these seven patients received decided benefit from the very beginning of this mode of treatment. In the acute cases they recovered in from ten days to a month; in the chronic cases they improved notably and gained daily. Just how to explain the action of this drug on sciatic disturbances, says Dr. Krauss, is extremely difficult; to say that it has the effect of dilating the arterioles of the nerve sheaths, affording more nourishment to the nerve, might answer in cases of neuralgic sciatica, but would hardly be accepted for neuritic sciatica. The action in these latter cases can be explained in no satisfactory way, and therefore had better be left unexplained. The only discomforts arising from the use of the drug noted by Dr. Krauss were congestive headaches and flushing of the face sometimes following the first dose of the medicine, while in other cases they did not supervene until the maximum doses were administered. To counteract these effects, he says, the bromides may be used, thus robbing the nitroglycerin of all the physiological effects where they are *not* wanted, and allowing them to proceed without hindrance in those places where they are desired.

Dr. Krauss adds: "I do not wish to convey the idea that nitroglycerin will cure every case of sciatica—far from it; but if it cures 50 per cent. of all cases in a period of from one to three weeks, it will be doing what no other drug or measure has heretofore done. If after a period of administration of ten days no perceptible effects have been obtained, it should be abandoned and kept in store for the next case. The treatment of anæmic conditions, diatheses, and local causes, such as pressure—these, perhaps, provoking and setting up the sciatic pain—must, of course, be considered and carried out in conjunction with the special treatment. From my experience I should advise *beginning* the treating sciatica with nitroglycerin, and only after its inability to cure is apparent falling back upon the other drugs and measures with which we are all acquainted."

Dr. G. Lindsay Turnbull (*Lancet*, Feb. 8, 1896), who records a case of the successful use of nitroglycerin in the treatment of *gallstone colic*, suggests its use when morphine is not well borne.]—Jeremiah T. Eskridge.

NITROHYDROCHLORIC ACID, or *nitromuriatic acid, aqua regia, acidum nitrohydrochloricum* (U. S. Ph.), contains 18 parts of nitric acid and 82 of hydrochloric acid, is of an orange-yellow colour, and is highly corrosive, but is somewhat unstable, and should be freshly prepared to be of the highest therapeutic value. Although strongly *escharotic*, it is never employed as a caustic, and possesses no advantage over nitric acid. In the proportion of 1 fl. oz. to the gallon of warm water it is often used for sponging *cachectic children* that have a dry, wrinkled skin, white pasty stools, and an inclination to gæophagia. A somewhat stronger solution—from 2 to 3 fl. oz. of the acid to the gallon of water—is very serviceable in the treatment of *jaundice* due to duodenitis or malaria; it is used for sponging the surface of the body and as a pediluvium, or a general bath in it may be taken. Nearly all *chronic*, but not the acute, *diseases of the liver* are benefited by the constant wearing of a broad bandage moistened in a solution of this strength and covered with oiled silk, over the region of the liver. The efficacy of the external application of this acid is usually increased by its simultaneous internal administration. *Dysentery, jaundice*, and *dropsy of hepatic origin*, especially in persons residing in hot climates, are also generally alleviated by a continued use of it. In *constitutional syphilis* it is more useful than nitric acid, particularly after a long course of potassium iodide and mercury. It may be used in place of nitric acid in the various *digestive disorders, lithæmia*, etc., and often is more efficient, but no rule can be given for the selection of the cases in which it would be the more appropriate. In *xanthelasma, acne*, and all *cutaneous affections* due to or aggravated by digestive disturbances it is a highly useful adjuvant to any special treatment which may be indicated. It is advised that it should not be combined with alcoholic solutions, as sufficient gas may be given off to cause an explosion. The dose is from 3 to 6 drops, well diluted, three times daily. The dilute acid, *acidum nitrohydrochloricum dilutum* (U. S. Ph., Br. Ph.), is of about one third the strength of the undiluted, and may be given in doses of from 10 to 20 drops, but is not very reliable, as the reaction between the diluted acids used in its preparation is very different from that which occurs when the undiluted acids are mixed.—Russell H. Nevins.

NITROUS OXIDE, *laughing gas, protoxide of nitrogen*, or *nitrogen monoxide*, is a colourless, transparent gas of the specific gravity of 1·527 and of neutral reaction. It has a sweetish odour and scarcely any taste. It is made by careful heating of nitrate of ammonium, NH_4NO_3, which splits up into water and nitrous-oxide gas, N_2O. To be freed from any trace of acid or nitric oxide, the gas should be passed through a solution of hydrate of potassium and a solution of ferrous sulphate, and should be held over water in a jar for at least twenty-four hours. Nitrous-oxide gas supports combustion almost as well as oxygen. By pressure, a colourless liquid may be made of the gas, and further pressure will cause its solidification. Water will take up almost its own bulk of nitrous-oxide gas.

Priestley discovered the gas, but Sir Humphrey Davy was the first to discover its *anæsthetic* properties. It was his belief that it could be substituted for oxygen in inspired air; but this has since been proved false by the researches of Hermann and of Amory (*N. Y.*

Med. Jour., Aug., 1870). Davy did not carry his experiments far enough, however, to realize the possibility of the use of nitrous-oxide gas for surgical purposes. Mr. Colton, now an aged man living in New York, was demonstrating the anæsthetic properties of the gas in one of his public exhibitions in which persons under its influence seemed to feel no sensibility to pain, when the notion was seized by Horace Wells, a dentist of Hartford, Conn., to use the substance for the painless extraction of teeth. Dr. Wells made an unsuccessful effort in 1844 to induce the medical profession to adopt nitrous oxide as a general surgical anæsthetic, but his attempt failed. It was not until 1863 that it came fully into vogue among dentists. Since that time it has been used for anæsthetic purposes on a gigantic scale all over the civilized world.

For our knowledge of the physiological action of nitrous oxide we are indebted principally to Hermann (*Arch. f. Anat. u. Physiol.*, 1864), Amory (*loc. cit.*), and Zuntz (Pflüger's *Archiv*, Bd. 17, 1878, i and ii). Though there is a difference in the methods employed by these observers, their results are almost identical. Arterial blood shaken up with nitrous-oxide gas becomes dark, and venous blood remains dark. Inhaled pure, the gas produces a feeling of suffocation and at the same time of stimulation. The gas is, therefore, not respirable in the true sense of the word, for it does not give up its oxygen to the blood. All observers are agreed that asphyxia is produced by this strong molecular cohesion, depriving the blood temporarily of a sufficient supply of oxygen. The anæsthetic properties of the gas lie in close connection with its asphyxiating tendencies.

On inhalation of nitrous-oxide gas, there is first noticed a stimulation of the entire system, as in alcoholic intoxication. The entire body tingles, and the keenness of the senses is accentuated. The pulse becomes fuller and more rapid, and the respirations are increased in frequency and are shallow. Consciousness is maintained up to this point, and the subject answers questions rationally. The face is pale. If the administration of the gas is continued, the face and visible conjunctivæ become deeply cyanosed, and the breathing grows stertorous. Consciousness disappears and anæsthesia of the senses follows, sensation and muscular power being the last to disappear. Unless the use of the anæsthetic is continued, the abolition of sensation lasts but a minute or two, the patient recovering from the influence of the narcotic as soon as oxygen is inhaled. Rhythmic muscular movements, twitchings, or rigidity may manifest themselves during the anæsthesia; or, on recovery, there may be erotic symptoms or hysterical conduct.

During the second period of anæsthesia, when the face is dark and the pulse scarcely perceptible, it is well to guard against the possibility of complete asphyxia or the appearance of convulsions by giving the patient a few whiffs of atmospheric air. During the period of insensibility, dilatation of the pupil, impeded respiration, irregularity of the heart, and diminished pulse-rate are often seen. Warner (*Lancet*, June 17, 1882, p. 985) reports that he has seen coma, hemiplegia, catalepsy, hysteria, and clonic convulsions follow the use of laughing gas. Cardiac disturbances are not rarely witnessed, and an interesting case is recorded by Ottley (*Lancet*, Jan. 20, 1883). Lafout has observed a transient albuminuria and glycosuria following the inhalation of nitrous-oxide gas (*University Med. Mag.*, vol. ii, p. 248). The great majority of people may be narcotized without any disagreeable occurrences. Occasionally, however, persons are met with who complain of an "anxious feeling" about the breast—something like that witnessed in pseudo-angina pectoris. Sometimes the psychical effects of the gas are disagreeable rather than pleasing, and the occasional slight convulsions already noted indicate an irritation of the cerebral cortex. Long-continued anæsthesia with this gas may be followed by a venous condition of the arterial blood, due to the deprivation of oxygen from the hæmoglobin of the red blood-cells.

Erotic excitation is not uncommonly observed after nitrous oxide anæsthesia. The same precaution of having a third responsible person present during the narcosis of females should be observed as in ether anæsthesia. Vomiting and nausea practically never occur in the use of this gas. Minor operations under its influence can therefore be undertaken without consideration of a previous meal.

Recovery from the influence of nitrous oxide is marked by a slight mental dulness, which rapidly disappears. The face and visible mucous membranes return to their normal colour, and within a minute or a minute and a half the patient is entirely conscious. He may laugh or cry for a few minutes, or may remain very solemn in his demeanour.

That nitrous oxide is the safest of the three great anæsthetics is axiomatic. Deaths after or during its use are extremely rare. Thus, Darin, making a statistical comparison, gives these figures: Chloroform, one death out of 2,872 anæsthesias; ether, one out of 23,203; and nitrous-oxide gas, one out of 100,000 (*Brit. Med. Jour.*, Jan 24, 1885). The present writer has been able to find but eighteen cases of death from nitrous-oxide, one of these being an unrecorded instance. The gas is used, undoubtedly, hundreds of thousands of times annually, and report is certain to be made of a fatal result in its administration. Evidence is almost unanimous that it is the safest of the general anæsthetics.

Holden has pointed out that inhalation of the gas may be followed by hæmorrhagic tendency, and that its employment is always attended with pulmonary engorgement. He regards nitrous oxide, therefore, as contra-indicated in pulmonary disease, particularly when there has been a hæmoptysis, and in hæmophiliacs (Kappeler, *Anæsthetica*, Stuttgart, 1880).

Nitrous-oxide gas has its greatest use among dentists in the *extraction of teeth* and their *roots*. Among surgeons it has gained wider and wider favour during the last decade for

use in *minor operations of short duration*. Unfortunately, its physiological action is so supreme that it will not admit of prolonged employment. It is called into requisition for the *opening of abscesses, tenotomies*, and the *reduction of dislocations* and *fractures*. Barton recommended it highly for the last-mentioned purposes, because of its safety and the quick muscular relaxation it produces (*Phila. Med. Times*, vol. xvi, p. 108). It can be satisfactorily used in operating an *ingrown toe nail* and in *circumcision*. In fact, in any surgical procedure which requires only a short anæsthesia, nitrous-oxide gas has its distinct indication. More extensive operations than those indicated have been performed with the use of nitrous oxide. Carnochan, in England, removed a woman's breast, giving the patient alternate inhalations of the gas and of atmospheric air. The late Dr. J. Marion Sims extirpated an abdominal tumour with a nitrous-oxide anæsthesia lasting twenty minutes.

The use of the gas in *labour* has naturally been tried. Zweifel and Döderlein, of Erlangen, made a thorough research in regard to it (quoted in *Brit. Med. Jour.*, Nov. 7, 1885), and found that it did not retard labour in the later stages, as chloroform does. Sensation is benumbed, but the patient remains conscious. This obtundity of pain lasts long enough to suture a *ruptured perinæum*. Nitrous-oxide gas could be introduced into private obstetrical practice only under peculiarly favourable circumstances; and, indeed, so rare is a death from chloroform during confinement that the obstetrical use of laughing gas will probably always remain restricted to maternity hospitals. No great advantage seems to accrue from mixing it with oxygen in the proportion of 4 to 1, as has been proposed.

At the present day English surgeons frequently begin an ether narcosis by rendering the patient unconscious with nitrous-oxide gas. By this means the primary disagreeable effects of ether are obviated.

The gas may be administered in two ways. Both methods require, besides the iron reservoir, a caoutchouc bag connected by rubber tubes with the reservoir on one side and with a mouthpiece on the other. This mouthpiece is furnished with a valve opening outward, allowing the expired air to escape. With each inspiration the valve closes, permitting only pure gas to enter the lungs. A lever-like arrangement renders it possible to administer gas and atmospheric air at the same time. In the first method, pure nitrous oxide is given for inhalation for from one to two minutes, followed by an occasional whiff of atmospheric air. The second manner of inducing anæsthesia is characterized by permitting the simultaneous inhalation of the gas and air. The latter requires a longer time to accomplish the purpose, and the narcosis is more difficult to produce. The method first described is the one in most common use. The only objection to the apparatus above defined is that an appreciable quantity of gas is lost. To overcome this loss, an apparatus has been devised for institutions where much gas is used in which the expired air is returned to the reservoir after being passed through limewater to rid it of its contained carbonic-acid gas.

The advantages of nitrous-oxide gas as an anæsthetic may be said to be: 1. The rapidity of its action. 2 Its comparative and practically absolute safety. 3. The rapid return to consciousness and sensation. 4. The almost total absence of disagreeable sequelæ. Among its disadvantages are its unfitness for prolonged operations and the difficulty of transporting the necessary apparatus for its use.

Blake and Hamilton (*Med. Record*, Jan. 31, 1880) have recommended inhalations of nitrous-oxide gas in cases of *melancholia* and *nervous exhaustion*, as a hypnotic and stimulant. Its use in this connection has entirely disappeared. Dr. George J. Ziegler (Researches on the Medical Properties and Application of Nitrous Oxide, Philadelphia, 1865) has also urged the employment of the gas in small quantities in "permanent chemico-organic, arterial, nervous, and cerebral changes," and as a "general stimulant" in all asthenic diseases. These suggestions undoubtedly rested upon the belief, now known to be false, that the oxygen of the gas was given up to the blood.

Nitrous-oxide water is water impregnated with nitrous oxide under pressure. This was known as "Searle's patent oxygenous aerated water," and about fifteen years ago had a large sale as a diuretic, stimulant, and alterative. Sérullas employed it in Asiatic cholera. It possesses merely a historic interest.

[In the *Medical Record* for May 11, 1895, Dr. Charles G. Pease treats of the use of nitrous-oxide gas as an anæsthetic in prolonged operations. As anæsthesia, he says, may be prolonged with the gas up to one, two, three, and four hours, with so much greater safety to the patient than with other anæsthetics, and with no unpleasant sequelæ, it must surely come into more general use. He admits that he finds it far more tiring to administer gas than to administer the other anæsthetics, but that, he says, should have no weight, in view of the great advantages to the patient. Dr. Pease has devised a portable outfit consisting of small cylinders containing 100 gallons of gas each (condensed) with a convenient case for carrying them, a gas-bag, tubing, and an inhaler, with valves to admit air and shut off gas, and *vice versa*. The gas, he says, should never be administered to an alcoholic patient, and alcohol should not be allowed prior to the administration, as the patient is very apt to become unmanageable.

At a meeting of the New York Surgical Society held on November 27, 1895 (*Annals of Surg.*, Feb., 1896), Dr. Francis H. Markoe presented the subject of the use of oxygen in connection with that of nitrous oxide and ether (see under OXYGEN).]—SAMUEL M. BRICKNER.

NOSOPHENE, or *tetraiodphenolphthalein*, $(C_6H_2I_2.OH)_2.C<\overset{C_6H_4CO}{O}$, has recently been proposed as a substitute for iodoform. It is a yellowish powder, odourless and tasteless, insoluble in water, moderately soluble in ether

and chloroform, and soluble with difficulty in alcohol. It has the characters of a weak acid, and forms stable salts with bases (see ANTINOSINE and EUDOXINE, in the Supplement). It is said to contain 60 per cent. of iodine. Seifert (*Wien. klin. Woch.*, Mar. 21, 1895; *Brit. Med. Jour.*, Apr. 13, 1895), who seems to have introduced nosophene into use, says that it is absolutely non-poisonous, and that it does not part with iodine when taken into the organism. He has found it specially adapted, owing to its insolubility and lack of odour, to the after-treatment in cases of operations on the nares. He continues his report as follows: As an insufflation applied after the cautery (chemical or galvanic) it prevents suppuration and the formation of adhesions; in *rhinitis sicca* it causes no irritation and no secretion; in *rhinitis with excessive secretion* it diminishes the secretion and cures the inflammation quicker than bismuth, aristol, europhene, or sodium sozoiodolate; it appears to shorten the course of *rhinitis acuta;* in a case of *nasal diphtheria* in which it was used the membrane disappeared in four days; six cases of *balanoposthitis* were cured in three days; in cases of *soft chancre* it was equal to europhene, if precautions were taken to prevent its forming a crust and retaining the secretion by first cauterizing the sore with liquor ferri; in *hard chancre* the number of cases treated was too small to warrant him in forming any opinion. A case of *traumatic weeping eczema*, he adds, was cured in a remarkably short time by the application of nosophene in powder.

A 10-per-cent. nosophene gauze has been found by von Noorden (*Münch. med. Woch.*, 1895, No. 22; *Ctrlbl. f. Chir.*, July 27, 1895) quite as efficient as iodoform gauze for tampons.

NUCLEINS.—The nucleinic compounds are not of recent discovery. They were studied chemically as early as 1831 by Braconnot, by Tuevene in 1838, by Schlossberger in 1844, by Mitscherlich in 1845, and by Bechamp in 1865, but no special value was attached to these substances. In 1874 Miescher made an important contribution to our knowledge of the nucleins, and to him belongs the credit of giving them their name and first appreciating their physiological properties. Horbaczewski showed the relation of the nucleins to the formation of uric acid. Vaughan, aided by Dr. J. McClintock and Dr. Novy, demonstrated that some of the nucleins had germicidal properties,* and, continuing his experiments, with the assistance of Dr. McClintock, he reached the important conclusion that the germicidal properties of blood-serum were due to the presence of nucleins in it.† Through the careful experimental investigations of Professor Vaughan and his assistants, and the clinical observations of Vaughan and Dr. John Aulde, of Philadelphia, the nucleins, as therapeutic agents, have attracted considerable attention in this country.

Professor Vaughan (*Jour. of the Am. Med. Assoc.*, June 2, 1894) says: "Physiologically, nucleins may be said to form the chief chemical constituents of the living parts of cells. Speaking broadly, we may say that the nuclein is that constituent of the cell by virtue of which this histologic unit grows, develops, and reproduces itself. It is the function of the nuclein of the cell to utilize the pabulum within its reach. It must be evident that those tissues most abounding in cellular elements contain relatively the largest amounts of nuclein. It must also be seen that it is by virtue of their nuclein that the cells of various organs and organisms possess and manifest their individual peculiarities. We should therefore expect to find that the nuclein of the yeast cell is not identical with that of the *Bacillus tuberculosis*, and that the nuclein of the spleen differs from that of the thyreoid gland. The number of kinds of nuclein is limited only by the varieties of cells. Nuclein is the chemical basis of that part of the cell designated by the histologist as the nucleus, sometimes called chromatin on account of the readiness with which it absorbs and holds colouring agents. It is the nuclein of the bacterium which takes up and retains the stains, and it is on account of this fact that the nuclein of the *Bacillus tuberculosis* differs from that of other bacilli that we are able to distinguish the former from the latter by its tinctorial properties. Differences in reaction with staining reagents, so plainly seen under the microscope, are only outward manifestations of less apparent and more important differences in chemical composition.

"Chemically, the nucleins are complex proteid bodies characterized especially by the large amount of phosphorus they contain. The phosphorus exists in the form of nucleinic acid, which is combined with a highly complex basic substance. So far as we know at present, the nucleinic acid of all nucleins is the same, yet the basic part differs in the various nucleins. This basic substance yields, as decomposition products, one or more of the so-called xanthine bodies, adenine, guanine, sarkine, and xanthine. Some nucleins yield only adenine, and these may be designated as adenyl nucleinic acids. Those which furnish xanthine most abundantly may be called xanthyl nucleinic acids. Generally speaking, the nucleins are insoluble in dilute acids and soluble in dilute alkalies. They resist peptic digestion, and in this way may be separated from most other proteid bodies.

"Certain substances which are histologically and functionally nucleins do not yield any xanthine base as a decomposition product.

* Dr. John Aulde (*N. Y. Med. Jour.*, Sept. 29, 1894, p. 392) states that in 1879 Kossel demonstrated that the nucleins possessed germicidal properties. Professor Vaughan, in answer to my inquiries concerning the discovery of the germicidal properties of the nucleins, says: "The first paper on the germicidal action of the nucleins from this laboratory was published in May, 1893. Kossel's paper was published in February, 1894."

† For brief references to the principal literature relating to the history and discovery of the nucleins and their properties, the reader is referred to the able articles by Professor Vaughan, *Med. News*, Dec. 23, 1893, and *Jour. of the Am. Med. Assoc.*, June 2, 1894.

These are now called paranucleins. Some of these are the antecedents of true nucleins. Thus the yolk of the egg contains a paranuclein, which may be isolated by removing the accompanying proteids by peptic digestion. This substance does not yield any xanthine base, but during the process of incubation it develops into a true nuclein.

"Some nucleins are combined with albumins, forming compounds known as nucleo-albumins. When one of these bodies is submitted to peptic digestion, the albumin is converted into a peptone, and the nuclein forms an insoluble precipitate. The casein of milk is a nucleo-albumin, the albumin of which is peptonized by gastric digestion."

The nucleins may be obtained from various sources—from yeast, casein, the nuclei of blood- and pus-corpuscles, the liver, the spleen, bone-marrow, the thyreoid gland, the thymus gland, the spermatozooids of various animals, the testicles, the yolk of hen's eggs, the brain, or any gland, organ, or structure containing numerous cell elements.

[Hammarsten (*Ztschr. f. physiol. chemie*, xix; *N. Y. Med. Jour.*, Aug. 25, 1894) has recommended the following classification of nucleins and nucleo-compounds:

Nuclein, to designate, after Kossel, such phosphorus-containing substances as remain in the peptic digestion of complex proteids, which further are compounds of albuminous substances with nucleic acid and yield xanthine-like bases by decomposition.

Paranuclein, to include, after Kossel, nuclein-like bodies which are formed in peptic digestion of simple albuminous substances, but which do not yield nuclein bases. Since these substances differ much among themselves, and are only similar in that they resemble nucleins in certain particulars, Hammarsten suggests that they be called *pseudonucleins*.

Nucleoalbumin, to include only phosphorus-containing simple albuminous substances, such, for example, as casein, which are not compound proteids, and by peptic digestion yield pseudonucleins.

Nucleoproteids, to include all complex proteids which by peptic digestion yield, beside simple proteids, true nucleins, and give by more profound decomposition nuclein bases. To this class belongs a compound which Hammarsten has discovered in the pancreas and calls the pancreatic nucleoproteid. It is made up not only of nuclein in combination with an albuminous substance, but contains some third part, perhaps animal gum, which, by heating with dilute acids, yields a reducing body. Hammarsten is unable to state the exact nature of this reducing substance, though the evidence favours the view that it belongs to the penta-glucoses.

Chittenden (*N. Y. Med. Jour.*, Apr. 11, 1896) sees little to be gained by attaching any special significance to the terms nucleoalbumin and nucleoproteid, and thinks that Hammarsten's suggestion, if followed, would "only lead to increased confusion and probable misinterpretation." Concerning the chemistry of the nucleins, Professor Chittenden says:

"On the basis of our present knowledge, we may perhaps make a division of nuclein bodies into the following groups:

"1. Nucleic acids, bodies rich in phosphorus, which contain no proteid matter, and yield on decomposition only phosphoric acid, nuclein bases, and sometimes carbohydrate bodies. They may occur free in some animal cells, as in spermatozooids, but are more generally united with more or less proteid matter. To this group may be added paranucleic acid, which, however, must have a widely different constitution, in that it does not yield any nuclein base on decomposition.

"2. True nucleins, such as are present in cell nuclei, either as such or joined to proteid matter as a part of more complex molecules (nucleoproteids), containing variable amounts as well as variable kinds of nucleic acids, and yielding by decomposition proteid matter, nuclein bases, and phosphoric acid.

"3. Paranucleins, obtainable especially from nucleoproteids with a low content of phosphorus, such as are present in the cytoplasm of the cell, in egg yolk, and in milk. Paranucleins yield on decomposition proteid matter and phosphoric acid, but little or no nuclein bases—*i. e.*, they are compounds of proteid matter with a small amount of paranucleic acid.

"4. Nucleoproteids or nucleoalbumins, phosphorus-containing proteids, widely distributed through all animal cells, and which by pepsin-acid digestion yield soluble proteid products and true nuclein, the latter giving on further decomposition nuclein bases.

"5. Paranucleoproteids, phosphorus-containing proteids, which by digestion with pepsin acid yield insoluble paranuclein, together with soluble proteoses and peptones.

"Unquestionably, the members of these different groups range into each other by almost insensible gradations. Further, many of the nucleoproteids, with a low content of phosphorus, are hard to distinguish from true globulins, and frequently it is only by a determination of the presence or absence of phosphorus that a definite conclusion as to the true nature of the body can be reached.

"The properties and general characteristics of the nucleoproteids and nucleins depend, as has been stated, mainly upon the amount and character of the nucleic acid united to the proteid matter. Further, in the majority of the tissues of the body nucleoproteids with some paranucleoproteids are mainly met with, these bodies being especially abundant in the caryoplasm and cytoplasm of the cells, nucleins and free nucleic acids being less abundant. From all nucleoproteids, however, nuclein and nucleic acid can be prepared by proper methods of treatment. The larger the proportion of nucleic acid in the nucleoproteid or nuclein the more acid its character, and the chief difference between a nuclein and a nucleoproteid is found in the proportion of nucleic acid to the proteid matter. Hence, digestion of a nucleoproteid with gastric juice naturally gives rise to a nuclein, since the proteolytic action of the digestive enzyme results in a solution of

the superfluous proteid matter. Variations in the amount of nucleic acid and proteid matter in a nucleoproteid obviously affect the ordinary reactions of the body, notably its solubility, etc. Nucleoproteids and nucleins rich in phosphorus are more likely to be found associated with the nuclei of cells, while nucleoproteids with a small amount of phosphorus are more abundant in the cytoplasm.

"If we examine the composition of a few of the nucleoproteids and nucleins that have been separated from different tissues and organs, we gain a very clear idea of the great variation in the proportion of nucleic acid and proteid matter in these compound bodies. Thus, the peculiar nucleoproteid separated by Hammarsten from the pancreas contains 4·48 per cent. of phosphorus; the nuclein of yeast cells Kossel found to contain about 6·19 per cent. of phosphorus; the nuclein of egg yolk, according to Bunge, contains 5·19 per cent. of phosphorus; the peculiar nucleoproteid (nucleohiston) separated by Lilienfeld from the nucleus of lymphocytes contains 3·02 per cent. of phosphorus; while in the cytoplasm of leucocytes from the thymus and lymph glands the same investigator found only 0·43 per cent. of phosphorus. Probably the great majority of the organs of the body contain nucleoproteids with a comparatively small percentage of phosphorus. The nucleoproteid obtained from red marrow by Halliburton and Forrest, however, contains 1·6 per cent. of this element, and from the liver a nucleoproteid has been separated with 1·45 per cent. of phosphorus. From the brain a nucleoproteid has been obtained with 0·5 per cent. of phosphorus, while in the kidney there is present a nucleoproteid with only 0·37 per cent. of phosphorus."

Professor Chittenden says, in regard to certain nuclein products in the market: "In some cases the method of manufacture has apparently had for its object the separation of a pure nuclein or nucleic acid, freed so far as possible from all other cell or tissue constituents, as in the '*nuclein solution, standard, formula of Dr. John Aulde*,' which is 'made from thyreoid and thymus glands,' and in the '*improved nuclein solution*' *manufactured by Parke, Davis, & Co.*, which is stated to be a 'pure nucleinic acid from yeast.' In the preparation known as '*protonuclein*,' on the other hand, the process of manufacture is stated to consist 'in the mechanical separation of the cellularly active constituents' of various lymphoid structures and glands, the product presumably consisting of the entire contents of the cells, and hence composed not only of the nucleins and nucleoproteids naturally present there, but also of considerable other material belonging to the substance of the cells.

"Taking the amount of phosphorus contained in these products as an index of the proportion of nucleoproteid or nucleic acid present, we may draw some inferences as to the character of these pharmaceutical preparations. A sample of 'nuclein solution, standard,' recently analyzed by the writer, failed to show any phosphorus whatever, from which the conclusion seems obvious that the solution contains no nuclein. 'Tablets of nuclein solution' made by the same manufacturer likewise failed to show any appreciable amount of phosphorus.

"A sample of 'protonuclein special'—a dry powder—recently analyzed, contained 1·25 per cent. of phosphorus, an amount of phosphorus which accords with the view that the preparation represents a mixture of cell nucleoproteids with other cell material. Nearly two thirds of this phosphorus belongs to matter soluble on addition of water—*i. e.*, to nucleoproteids which dissolve in the water or in the dilute saline solution which results on the addition of water. 'Protonuclein powder,' which is presumably a dilution of the preceding preparation with milk sugar, was found to contain 0·22 per cent. of phosphorus.

"The 'improved nuclein solution,' manufactured by Parke, Davis, & Co., is stated to be a one-per-cent. solution of pure nucleic acid from yeast, containing six per cent. of phosphorus. A sample of this solution recently analyzed was found to contain 0·078 per cent. of phosphorus, which would imply the presence of even more than one per cent. of such a nucleic acid. From the solution the nucleic acid itself can be partially separated by precipitation with a little dilute hydrochloric acid and the addition of alcohol. A sample of the acid so precipitated and dried was found on analysis to contain 5·71 per cent. of phosphorus, so that it is evident that a very pure nucleic acid, and one with a high content of phosphorus, can be separated and made available in fluid form. In this 'nuclein solution,' therefore, we have pure nucleic acid isolated by chemical methods from its natural combination with the proteid matters of the yeast cell, and held in solution by the action of a weak alkali. In 'protonuclein,' on the other hand, we have the nucleoproteids and nucleins of various gland cells without chemical separation from the other cell constituents. It is therefore obviously not a pure nuclein, which, indeed, it does not purport to be, but rather a product containing all the cellular elements characteristic of the tissues from which it is derived."]

Manner of extracting the Nucleins.—In the *Medical News* for May 20, 1893, p. 537, Professor Vaughan gives the details of his process of extracting the nuclein of the thyreoid gland, and also one for obtaining the nuclein of the yeast cells. Slight modifications of these processes are found described in the *American Therapist*, vol. ii, p. 79. In the case of extracting yeast nuclein, cells from a pure culture of yeast are washed with sterilized water by decantation, then placed in a 5-per-cent. solution of potassium hydrate and filtered. The filtrate is rendered feebly acid by hydrochloric acid, and the proteids are thrown down by adding 96-per-cent. alcohol. Vaughan recommends that the filtrate should be washed with alcohol until the supernatant fluid remains colourless. Two methods may now be followed; one is to dissolve the filtrate in a very dilute potassium-hydrate solution (0·25 to 0·50 per cent.); the other, and apparently the better way, is to digest out the other proteids

than those of nuclein from the alcoholic filtrate by means of hydrochloric acid and pepsin, very similar to the manner of procedure in extracting the animal nucleins. The nuclein of the testicle, of the thyreoid gland, or of almost any other animal substance is obtained by finely cutting or crushing the gland or substance from which the nuclein is to be separated, making an extract of this by means of equal parts of absolute alcohol and ether. The extract is then placed in 0·2-per-cent. hydrochloric-acid solution with pepsin, and kept in an incubator at 40° C. (102° F.) for two days, the digestive fluid being decanted and renewed several times. The digestive process is kept up until the fluid fails to respond to the biuret test for peptones. The undigested portion, which contains the nuclein, is washed on filter paper first by pouring a 0·2-per-cent. solution of hydrochloric acid over it and then alcohol. What still remains is dissolved in a 0·5-per-cent. solution of potassium hydrate and filtered through a Chamberland filter without pressure. The nuclein solutions, as thus made according to Vaughan's process, were found to be alkaline and too irritating for hypodermic administration. Both Vaughan and Aulde profess to have adopted processes by which a purely neutral and non-irritating nuclein solution is obtainable.

Germicidal Properties of the Nucleins.—The experimental observations of Lewis and Cunningham (1872), of Traube and Gschiedlen (1874), of Fodor, of Wysokowicz, of Grohmann and Schmidt, of Nuttall and Flügge (1888), of Nissen and Flügge, and of Behring, all proved conclusively the germicidal properties of blood. Buchner, in 1890, aided by Viot, Littmann, and Orthenberger, made a valuable contribution to our knowledge of the germicidal properties of blood, and came to the conclusion that the germicidal properties reside in the blood serum and was an albuminous constituent. The experiments of Halliburton, Hankin, Bitter, Christmas, Emmerich, Tsuboi, Steinmetz, and Löw seem to justify the conclusion that "it is possible, *but highly improbable*, that the germicidal substance is not the serum-albumin, but some substance that is precipitated along with this by alcohol and other agents." Professor Vaughan (*Med. News*, Dec. 23, 1893) extracted a nuclein from the serum of blood taken from dogs and rabbits, and demonstrated by a number of experiments that the nuclein possessed germicidal properties.

In the *Journal of the American Medical Association* for June 2, 1894, a number of experiments by Vaughan are recorded which seem to demonstrate quite conclusively that certain animals, at least, may be rendered proof against diseases most fatal to them by first treating them with hypodermic injections of nuclein. The diplococcus of pneumonia was injected into rabbits. This germ in its virulent form is said to be practically always fatal to rabbits, death taking place on the second or third day. A 2-per-cent. yeast-nuclein solution was used, and of this 1 c. c. (about 15 minims) was given hypodermically every day or every alternate day for a number of days prior to injecting the diplococcus of pneumonia. It was found that the longer the nuclein treatment was continued, the more frequently the injections were made; and the sooner the germ was injected after daily treatments with the nuclein were stopped, the greater the immunity of the animal to the poison.

The next step in Vaughan's investigations was to determine whether the immunity secured by the use of a nuclein was due to the direct germicidal action of the nuclein or to its stimulating "effect on some organ whose duty it is to protect the body against bacterial invasion." Eight rabbits received each 2 c. c. (about 30 minims) of the nuclein solution intra-abdominally immediately after having been inoculated with 0·2 c. c. (3 minims) of a virulent culture of the diplococcus of pneumonia. At the same time two control rabbits were inoculated with the same amounts of the virulent culture. Two days later all the animals were dead, and an examination showed that they had all died from the effects of the germ. From these results Vaughan concluded that immunity was not secured by the germicidal action of the nuclein, but by its stimulating effect upon some organ. His attempts to render guinea-pigs proof against tuberculosis have been more or less contradictory and unsatisfactory, but his recent experimental investigations seem to demonstrate quite conclusively that rabbits may be rendered proof against tuberculosis by previous treatment with yeast nucleinic acid (*Med. News*, Dec. 15, 1894, p. 657).

Therapy.—Nuclein therapy is as yet in an early experimental stage, and many of the beneficial results alleged to have been obtained from the use of nucleins have not come to us surrounded with sufficiently accurate and scientific observations to enable us to accept them unqualifiedly. Theoretically, nothing could be more fascinating than the contemplation of the possibilities of the nucleins in the prevention and cure of disease, but experience and common sense teach us to wait, watch, and observe practical results.

According to Metchnikoff's phagocytic theory, the white corpuscles of the blood are the natural defenders against bacterial invasion. Dr. Huber, working under the direction of Vaughan, maintains that subcutaneous injections of nuclein increase the white blood-corpuscles.* Vaughan has demonstrated that the nucleins possess germicidal properties. He is convinced, however, that a nuclein, when introduced into the system for the purpose of rendering the subject proof against the invasion of germs, or that of destroying them when they have already found a lodgment in the system, does not act directly as a germicide, but as a substance which stimulates "the activity of those organs whose function it is to protect the body against" bacterial invasion. He makes the following condensed statements,

* Dr. William S. Carter, of Philadelphia, in a series of elaborate investigations on the subject of leucocytosis, concluded that injections of nucleins did not cause any distinct increase in the number of leucocytes (*Univers. Med. Mag.*, Dec., 1894, p. 182).

based on his own investigations and those of his coworkers: "1. The subcutaneous injection of a nuclein increases the number of white blood-corpuscles. 2. This increase occurs in both healthy and tuberculous persons. 3. With like quantities of nuclein injected, the increase varies with the person. It may be slight and it may be threefold. 4. This increase occurs principally in the polynuclear cells. It is evident, as a rule, as soon as the third hour after treatment and generally disappears after the forty-eighth hour" (*Jour. of the Am. Med. Assoc.*, June 2, 1894, p. 831).

From the investigations of Professor Vaughan and others, the nucleins seem to be indicated as germicides in topical applications in certain diseased conditions of the mucous membranes and skin, in the prevention and probably in the cure of diseases of bacterial origin, and in atonic conditions, especially of the nervous system.

Prevention of Diseases by the Use of the Nucleins.—So far, about the only definite and positive experiments which have been undertaken to determine the "immunizing" effects of the nucleins against disease are those of Vaughan and his assistants, and these were performed principally upon rabbits and guinea-pigs. It was found that these animals, under certain conditions, on receiving nuclein, became proof against violent cultures of the diplococcus of pneumonia. From these experiments the following conclusions were drawn by Vaughan: "1. Rabbits and guinea-pigs may be protected against virulent cultures of the diplococcus of pneumonia by previous treatment with hypodermic injections of a yeast nuclein. 2. The immunity thus secured is not due to the action of the nuclein, as a germicide, directly. 3. The process of securing this immunity is an educational one, and most probably depends upon the stimulating effect of the nuclein upon some organ whose function it is to protect the body against bacterial invasion. 4. The longer the nuclein injections are continued and the more frequently they are administered, the more complete is the immunity which is secured. 5. In order to obtain this immunity, the inoculation with the germ must follow soon after the last treatment with the nuclein." The attempts to render guinea-pigs proof against the bacillus of tuberculosis by previous injections of nuclein have not been satisfactory. It was found by Vaughan that, while a nuclein solution in culture tubes containing the bacillus of tuberculosis usually destroyed the virulency of the germ, such a result did not invariably take place.* Against the germs of what diseases the human subject may be protected by the use of the nucleins has not been determined. It seems probable that, if it were possible to make man proof against the germs of disease, the immunity at most would be of short duration, and consequently of uncertain value.

* Professor Vaughan has almost invariably succeeded in rendering rabbits proof against injections of cultures of the bacillus of tuberculosis (*Med. News*, Dec. 15, 1894, p. 657). The length of the immunity has not been determined yet.

The Germicidal Value of Nucleins in the Treatment of Disease.—It seems to be evident, from the experiments of Vaughan, that it is only in cases where the nucleins can be brought in direct contact with diseased surfaces that we may expect much effect from the direct germicidal action of these agents. Such opportunities for the use of the nucleins are afforded in affections of the buccal and nasopharyngeal mucous membrane and in indolent ulcers of the skin. They have been employed in the treatment of *diphtheria* due to the Klebs-Löffler bacillus, *pharyngitis* due to the streptococcus of diphtheria, follicular *pharyngitis, amygdalitis, hay-fever* (autumnal catarrh), and in one case of *indolent ulcer* on the leg, reported by Vaughan.

Diphtheria.—Dr. J. Mount Bleyer, of New York, in the *American Therapist* for November 15, 1894, p. 113, reports four cases of diphtheria, due to the Klebs-Löffler bacillus, treated by means of the nucleins with marked benefit, as shown by the decline of temperature on the second day after beginning with the nucleins, without a tendency to recurrence of fever after it had declined, and by loosening and discharge of the membrane. No unpleasant effects were observed from the nuclein, which was given hypodermically in doses varying from $\frac{1}{10}$ to $\frac{1}{4}$ of a minim of the standard solution every three hours. Dr. John Aulde (*N. Y. Med. Jour.*, Sept. 29, 1894, p. 396) states: "In quite a large number of cases where the symptoms pointed to diphtheria as the true condition, I have found nuclein solutions most efficacious, the false membrane, angina, anorexia, and restlessness all disappearing in less than twenty-four hours; and, although some fever remains for a day or two, if seen early in the attack, the most forbidding symptoms promptly yield to this form of medication. He prefers giving the medicine by the mouth to children, as it is tasteless, and they take it readily either in the form of tablets or solution. Dr. J. L. Porteous, in a recent report of nine cases of diphtheria due to the Klebs-Löffler bacillus, states that he used nuclein in four, with a fatal result in two of the four. In the two cases which terminated favourably the nuclein seemed to exert a direct beneficial influence on the progress of the disease. In the two cases which resulted in death the false membrane appeared to yield to the nuclein, but in one, profound blood changes with great depression, and in the other, kidney complication, seemed to decide the fatal issue.

The Streptococcus Diphtheria.—Dr. Victor C. Vaughan (*Jour. of the Am. Med. Assoc.*, June 2, 1894, p. 831) reports four cases of the streptococcus diphtheria treated by yeast nuclein. In one the patient was too young to gargle, and a spray composed of equal parts of a 2-per-cent. solution of yeast nuclein and salt solution, sterilized, was thrown into the nose and pharynx by means of an atomizer every three or four hours. In the three other cases the patients were able to gargle, and the same solution used for the first case was employed by this method for these, with more prompt and decided effect than was obtained from the

spray. In all there were a rapid fall of temperature, disappearance of the membrane, and a speedy return of the affected parts to a normal condition.

Amygdalitis and Pharyngitis.—Dr. John Aulde has reported favourable results from the nucleins in these affections. Professor Vaughan gives twelve cases of membranous amygdalitis rapidly cured by a gargle composed of equal parts of a 2-per-cent. solution of yeast nuclein and salt solution.

Indolent Ulcer.—Vaughan (*ibid.*) reports the case of a printer, forty years old, who had been under treatment for an ulcer of the leg for more than a year. The ulcer measured an inch and a quarter in length by half an inch at its widest part and showed no tendency to heal. When nuclein was resorted to, all other agents were discontinued. Injections of 80 minims of a 2-per-cent. solution of yeast nuclein were made into the tissues around the ulcer on eight different occasions, with the effect of causing a rapid healing of the ulcer. "The injections caused a burning sensation at the time, but immediately after each treatment the patient walked half a mile to his work and stood at his case each working day of the week."

If the nucleins stimulate the metabolic processes of the body, as they are supposed to do, it is evident that when they are used for their germicidal action, as in the above-mentioned cases, they also stimulate the nutritive functions and especially those organs concerned in the elaboration of material for protecting the body against the invasion of germs.

Tuberculosis.—Vaughan, in his able paper entitled The Nucleins and Nuclein Therapy (*ibid.*), says: "I have been using nuclein in the treatment of tuberculosis in man since May 1, 1893. At first I employed only yeast nuclein, but now I am using spleen nuclein in some cases. When sufficient evidence has been obtained either to reject or recommend the treatment, the results will be communicated to the profession. I may say, however, that only in initial cases may we expect any benefit, and even in regard to these I must have more abundant material and a longer experience before I can speak with any certainty" (June 2, 1894). In his recent article (Treatment of Tuberculosis with Yeast Nuclein, *Med. News*, Dec. 15 and 22, 1894, pp. 657 and 675) he gives us the results of his further experience with the yeast nuclein in the treatment of tuberculosis. After a careful study of the twenty-four cases of which he has given a detailed report, I am forced to the conclusion that the results have not been very gratifying, and no one appreciates this more keenly than Professor Vaughan himself, who shows all through his reports the unfavourable as well as the favourable symptoms experienced by his patients, exhibiting a state of mind so essential to the scientific observer, and especially to the clinician and experimental investigator. The best results were obtained by Vaughan in the local treatment of tuberculosis of the bladder, and the next in the early stage of pulmonary tuberculosis before the general health had been seriously involved, and prior to secondary infection of other portions of the body. In advanced cases the nucleins seemed to have nothing more than a tonic or stimulating effect. Dr. Henry Sewall, of Denver, has employed hypodermic injections of nuclein, obtained from Professor Vaughan, in twelve cases of pulmonary tuberculosis, but he is unable to draw any definite conclusions from this method of treatment further than that "cough and general symptoms are, in some cases, quickly improved," and adds: "Taking the vital condition as a whole, without reference to particular features, the nuclein treatment of tuberculosis is followed by such encouraging results as to warrant for it a thorough test." The few other cases of tuberculosis for which nuclein has been employed have not afforded flattering results.

The experiments of Vaughan and McClintock, while they demonstrated the germicidal properties of nucleins, showed quite conclusively that in the treatment of disease with whose germs the nucleins could not be brought in direct contact but little dependence could be placed upon their germicidal properties. It is probable that the nucleins may prove to be valuable agents in stimulating the vital forces of the human organism in the early stages of pulmonary tuberculosis, and may thus aid in deciding the battle in favour of the unfortunate sufferer. Which one of the numerous nucleins is the most potent for this purpose, or whether a combination of several (which is very probable) will prove more powerful, observation may enable the clinical investigator to decide.

[In the *American Lancet* for January, 1895, Dr. Charles W. Hitchcock, of Detroit, gives the history of a case of *hip-joint disease* in which great improvement followed the systematic use of nuclein (Parke, Davis, & Co's) hypodermically every second day. The patient ultimately recovered, and Dr. Hitchcock attributes the result "very largely, if not entirely, to the long and persistent use of nuclein."]

Pneumonia, Pleurisy, and Bronchitis.—The nucleins have been employed in the treatment of these diseases more for their supposed stimulating effect on the blood-making glands and excretory organs than for their antagonism to the diseased processes directly. Germain Sée states that he has obtained good effects from the use of spleen nuclein in the treatment of certain cases of *pneumonia* and *pleurisy*. Dr. John Aulde has observed marked improvement to follow the use of the nucleins in *chronic bronchitis* and *naso-pharyngeal catarrh*. Dr. Aulde also speaks highly of the therapeutic effects of nuclein in the treatment of *hay-fever* (*Am. Therapist*, Aug., 1894, p. 35). Cases of *malarial toxæmia* and of *chronic and recurrent malarial disease* have yielded quite promptly to the nuclein treatment in the experience of Dr. Aulde. The same writer reports numerous cases of *influenza*, *anæmia* and *general debility*, one of *chronic eczema*, and one of *night sweats* successfully treated by means of the nucleins. He also records one case of *chronic Bright's disease* in which the

patient was made more comfortable by the use of the nucleins.

There is danger of the eager and enthusiastic becoming too sanguine over the real and supposed results from the use of the nucleins, but if these agents possess one half the virtues alleged for them as stimulators of the various organs of the body, they will find a permanent and useful place in therapeutics, and in no class of cases will they be more welcome than in those of *general debility* and *neurasthenia*.*

[Dr. Charles P. Knapp, of Wyoming, Pa. (*N. Y. Med. Jour.*, Apr. 13, 1895), reports the beneficial action of nuclein in cases of *amygdalitis, malarial disease, scarlet fever, tuberculous adenitis*, and *diphtheria*.]

Dose and Administration.—Prof. Vaughan believes the pure nucleins to be wholly free from poisonous properties, and says that he has injected subcutaneously in man 46·653 grammes (1½ oz.) of a 2-per-cent. solution of yeast nuclein at one time without harm other than the temporary irritation caused by the large volume of fluid injected. He has administered by the mouth from 186·608 to 248·824 grammes (from 6 to 8 oz.) of the same solution during twenty-four hours without ill effect. It must be borne in mind that a much smaller quantity, from 15 to 60 grains of the 2-per-cent. solution, given hypodermically, may cause in some persons a rise of temperature of from two to four degrees. The average dose for an adult is about 0·0205 cubic centimetre (⅓ of a minim) of the standard solution, or 1 cubic centimetre of a 2-per-cent. solution, given every two, three, or four hours, according to indications. Usually one third of this quantity is given to children under five years of age. The solution, diluted with a few drops of water, may be placed on the tongue and allowed to be absorbed without swallowing, but there seems to be no necessity for this precaution, as the nucleins are probably not affected by the gastric secretions. A convenient method of administration is in the tablet form. Heretofore there has been a preference for introducing the nucleins into the system by the hypodermic method, but I am not aware that any comparative studies have been made regarding the relative value of these methods of administering the nucleins. When the hypodermic method is resorted to, thorough aseptic precautions must be observed.

[Dr. William Jacobsohn, of New York (*Med. Record*, May 4, 1895), ascribes to nuclein whatever efficiency the diphtheria antitoxines and other cognate remedies may have. In a subsequent article (*N. Y. Med. Jour.*, July 20, 1895) he reports cases of *scarlet fever, measles, diphtheria*, and *follicular amygdalitis* treated with nuclein.

"Believing," says Dr. Jacobsohn, "that the body must contain the antitoxine which destroys the microbes and its poisons, and that this antitoxine must be nuclein, I have made an injection of this substance whenever the person has been exposed to a communicable disease. I have found that diphtheria, measles, and scarlatina, the only diseases in which I have made the experiments up to this writing, can be prevented by a timely injection of nuclein. It occurs to my mind that the other communicable diseases may likewise be prevented. The persons receiving the injections have been those directly exposed and living in the same apartments with the patients. No quarantine was used; the dose given was 5 minims of nuclein solution."]

JEREMIAH T. ESKRIDGE.

NUTGALLS.—See GALLS.

NUTMEG, *myristica* (U. S. Ph., Br. Ph.), *semen myristicæ* (Ger. Ph.), is the dried seed of *Myristica fragrans* deprived of its testa. The nutmeg tree is a native of the Moluccas and neighbouring islands, but it is now generally cultivated in the East and West Indies. The nuts contain starch, fixed oil or fat, albuminoids, and a volatile oil. The dose of the powdered nutmeg is from 5 to 20 grains.

Nutmeg butter, or concrete oil of nutmeg, *oleum myristicæ expressum* (Br. Ph.), is made by bruising nutmegs, exposing them to steam, and compressing them between heated plates or rollers. It is a solid, soft, yellowish, unctuous substance that has the characteristic odour and taste of nutmeg, and is composed of a true fat, *myristin*, $C_3H_5(OC_{14}H_{27}O)_3$, which yields myristic acid, $C_{14}H_{28}O_2$, on saponification.

Volatile oil of nutmeg, *oleum myristicæ* (U. S. Ph., Br. Ph.), is a limpid, straw-coloured liquid possessing a pungent taste and the odour of nutmeg. It is obtained from powdered nutmeg by distillation with water. The dose is from 1 to 5 minims.

Essence, or spirit, of nutmeg, *spiritus myristicæ* (U. S. Ph., Br. Ph.), is a 5-per-cent. solution of the volatile oil in alcohol. It is used for flavouring. The dose is from ½ to 2 fl. drachms.

Nutmeg possesses *aromatic, carminative*, and some *narcotic* properties. In large doses it has produced in man frontal headache, vertigo, delirium, and stupor. Injected into the circulation of the lower animals, the oil causes slowness of respiration, loss of reflex activity, and profound sleep; it has but a moderate sedative influence on the heart.

The volatile oil is a *rubefacient*, and may be applied in *rheumatism* and *neuralgia*. Powdered nutmeg may be applied in a poultice to relieve *colic* in infants, and as a mild rubefacient. Internally, nutmeg may be used as a carminative and anodyne in *gastralgia, enteralgia, nausea*, and *enteritis*. It is a spice that is generally used in flavouring desserts and farinaceous foods.

[Poisoning is occasionally produced by the ingestion of large quantities of nutmeg, the symptoms culminating in collapse in severe cases, although no fatal result is recorded.

* I have used 1,500 nuclein tablets, prepared by Charles Leedom, of Philadelphia, each containing ⅓₀ of standard nuclein solution, and solutions of nucleins made by Parke, Davis & Co. and by Leedom, principally cases of nervous exhaustion, but so far I have been unable to attribute much benefit to the use of the nucleins.

The treatment should include the application of warmth and the use of cardiac stimulants.]

SAMUEL T. ARMSTRONG.

NUX VOMICA (U. S. Ph., Br. Ph.), *semen strychni* (Ger. Ph.), poison nut, Quaker button, is the seed of *Strychnos Nux vomica*, a tree of the *Loganiaceæ*, growing in India, Cochin-China, and neighbouring countries. All parts of the tree are bitter and poisonous. The seeds contain the alkaloids *strychnine* and *brucine* (see below) in combination with igasuric (strychnic) acid, also the glucoside *loganin*, a yellow colouring matter, a concrete oil, gum, starch, wax, and earthy phosphates.

Strychnine, strychnina (U. S. Ph., Br. Ph.), *strychninum* (Ger. Ph.), $C_{21}H_{22}N_2O_2$, which is also obtainable from other plants of the *Loganiaceæ*, notably *Strychnos Ignatii* (*Ignatia amara*), occurs in colourless crystals or as a white, crystalline powder, permanent in the air, of alkaline reaction, odourless, but of an intensely bitter taste perceptible in a highly dilute solution (1 in 700,000). It is soluble in 6,700 parts of cold water, in 2,500 of boiling water, in 110 of alcohol, and in 7 of chloroform; it is almost insoluble in ether. On account of its insolubility the alkaloid itself is rarely prescribed. The dose is from $\frac{1}{60}$ to $\frac{1}{30}$ of a grain, but after tolerance is attained much larger doses may be safely used.

Strychnine sulphate, strychninæ sulphas (U. S. Ph.), $(C_{21}H_{22}N_2O_2)_2H_2SO_4+5H_2O$, occurs as colourless, prismatic crystals, efflorescent in dry air, odourless, of an intensely bitter taste perceptible in a 1-to-700,000 solution, of neutral reaction, soluble in 50 parts of water, in 109 of alcohol, and in 2 of boiling water, but is almost insoluble in ether. It contains 75 per cent. of strychnine. The dose is from $\frac{1}{60}$ to $\frac{1}{12}$ of a grain.

Strychnine nitrate, strychninum nitricum (Ger. Ph.), $C_{21}H_{22}N_2O_2.HNO_3$, forms colourless needles of a silky lustre and very bitter taste, soluble in 90 parts of cold water, in 3 of boiling water, in 70 of alcohol, and in 26 of glycerin, but is insoluble in ether. It contains 84 per cent. of strychnine, and is preferred to the sulphate for hypodermic use, being less irritant. The dose is from $\frac{1}{60}$ to $\frac{1}{12}$ of a grain. The Ger. Ph. gives the maximum single dose as $\frac{1}{6}$ of a grain; the daily maximum as $\frac{1}{2}$ of a grain.

Strychnine arsenite, $C_{21}H_{22}N_2O_2.As_2O_3$ (unofficial), forms white cubical crystals, almost efflorescent in air, completely decomposed by heat, of a bitter and metallic taste, soluble in 35 parts of cold water, in 10 of boiling water, also in alcohol, less so in ether. The dose is from $\frac{1}{60}$ to $\frac{1}{30}$ of a grain, but, as it is highly toxic, the initial dose should never exceed the minimum given.

[*Strychnine hydrochloride*, or hydrochlorate, $2(C_{21}H_{22}N_2O_2.HCl).3H_2O$, is used in medicine in the form of *liquor strychninæ hydrochloratis* (Br. Ph.), which is a solution of the strength of about 1 part in 100. The dose is from 5 to 10 minims.]

The acetate, hydriodide, and hydrobromide are prepared by the chemists, but offer no advantage over the above-named salts.

Strychnine is one of the alkaloids which dissolve (as its salts do also) without colour in concentrated sulphuric acid, but, on adding to the solution some deoxidizing substance, a play of colours results, lead peroxide producing a beautiful blue, passing into violet, then red, and finally yellow (Marchand). A minute quantity of potassium bichromate produces similar results (Otto), while ceroso-ceric oxide causes a blue changing to violet, and then to a permanent cherry-red. If these tests are carefully applied, as minute a quantity as 1 in 900,000 of the solution may be detected (Wenzell).

Brucine, $C_{23}H_{26}N_2O^4$ (unofficial), occurs in colourless prisms, pearly flakes or masses, bitter, soluble in 850 parts of water, very soluble in alcohol (1 in 1½). It is with difficulty separated from strychnine, in many samples of which it occurs as an impurity. The dose is from $\frac{1}{10}$ to $\frac{1}{4}$ of a grain.

Brucine is detected by the red colour which it yields with nitric acid. Neither nitric nor sulphuric acid colours strychnine, unless brucine is present as an impurity, a test which distinguishes this alkaloid from several others. Brucine does not decompose iodic acid, and is thereby distinguished from morphine.

The incompatibles are bromides, chlorides, and iodides in the same solution, the strychnine being precipitated as a hydrobromide, etc. Solutions of strychnine salts are decomposed by the alkalies and their carbonates, and by tannic (not by gallic) acid, but are not affected by ferric salts. Oils and fats retard their absorption.

Physiological Action.—The action of nux vomica is that of its principal alkaloid, strychnine. Externally, the latter is a very powerful antiseptic, but too poisonous for safe use. In concentrated solution, hypodermically, it has a decided irritant action on the tissues. Internally, in small doses, its bitter quality makes it a good *stomachic tonic*. Increasing the vascularity of the gastric mucous membrane and promoting the secretion of gastric juice, also of the pancreatic and biliary secretions, it aids digestion and sharpens the appetite, but, like other bitter tonics, it deranges digestion when used excessively or for a long time. It directly stimulates the muscular coat of the intestines, increasing peristalsis and acting as a *purgative*; but restrains the fæcal discharges when their frequency is due to *atony of the bowel*. It stimulates the motor nerve-cells of the spinal cord, the cardiac motor ganglia, the respiratory and vaso-motor centres in the medulla, contracting the arterioles all over the body (though by full doses they are relaxed), and the excitability of the sensory nerves and their terminal elements. The result is that respiration is deepened and quickened, the action of the heart is increased and the blood-pressure raised, the field of vision is enlarged, the sight and hearing are sharpened, and the sense of touch is rendered more acute, but the cerebral convolutions are not affected. Excreted chiefly in the urine, it causes increased frequency of urination, and in excess produces spasm of the neck of the

bladder. It probably excites uterine contraction, but undoubtedly promotes menstruation, disposes to sexuality, and provokes erections of the penis.

The most marked feature of the action of strychnine is the great increase which it causes in the reflex excitability of the spinal cord and other reflex centres, such as the vaso-motor and respiratory centres in the medulla. When the dose is large this increase is so great as to induce convulsions and cause death by asphyxia. After a full dose ($\frac{1}{12}$ of a grain) the pupils become dilated, the limbs take on jerking movements, respiration becomes spasmodic and the lower jaw stiff, a sensation of cerebral tension may be felt, and sudden shuddering and anxiety follow, the face taking on an unmeaning smile (*risus sardonicus*). A toxic dose (from $\frac{1}{4}$ to 2 grains) produces powerful and characteristic convulsions of a tetanic character. Within an hour after its administration, sometimes after only a few minutes, the patient feels a sudden sense of suffocation and dyspnœa, the head and limbs begin to shudder and jerk, the latter are suddenly stretched out rigidly with hands clenched and feet arched, then the head is bent backward and at last the whole body becomes stiffly arched, resting on the head and the heels, the belly hard and tense, the chest fixed, and breathing all but arrested. In the height of the spasm the face is dusky and congested, and the eyeballs project. Nearly all the muscles of the body are affected, the contraction of those of the face causing a *risus sardonicus*, but the jaw muscles are not seriously affected until near the end, and never so powerfully as in tetanus. The pulse is very rapid, and the temperature of the body is above normal, but the intellect remains unclouded, and the patient often expresses a sense of impending dissolution. After the paroxysm has lasted a minute or two it usually relaxes for a time. In the interval the patient suffers from soreness of the muscles, feels exhausted, and sweats profusely, but before long becomes aware that the spasm is returning, and cries out for some one to hold him or to rub his limbs. The convulsions rapidly increase in severity, a breath of wind, the slightest noise, even a bright light, being sufficient to bring them on; and in one the patient may jerk himself out of the bed. At last the respiration stops in the middle of a fit, and the heart soon after ceases to beat. Death occurs, after two or three hours at most, by exhaustion and asphyxia from tetanic fixation of the muscles of respiration, consciousness being preserved until carbonic-acid narcosis sets in.

Strychnine exalts all the functions of the spinal cord—reflex, motor, vaso-motor, and sensory, the latter being the least affected. It has a selective action on the large multipolar ganglia in the anterior columns, which it first stimulates and finally paralyzes by over-stimulation, in this respect illustrating the rule that small and large doses of an active agent act antagonistically to each other. A massive dose seems to destroy the spinal and medullary functions as by a single blow. The spasms of strychnine may be distinguished from those of tetanus by their intermittency, the latter being constant, also by the meaningless smile, the less-marked trismus, the absence of a wound, and the rapid course of the symptoms, which all point to strychnine poisoning. Thebaine, the tetanizing alkaloid of opium, is also a spinal exaltant, and acts much the same as strychnine.

Strychnine does not directly affect the muscular tissue, the motor nerve-trunks or nerve-endings, or the cerebral convolutions. Occasionally, however, large medicinal doses cause a greatly heightened sensibility of the optic and auditory nerves, so that brilliant lights and loud sounds produce painful impressions; and in a few cases there is a true cerebral intoxication, resembling a slight degree of drunkenness. It probably affects all the nervous centres in some degree, the sensory, however, much less than the motor and vaso-motor ones.

Strychnine is to some extent oxidized and destroyed in the body, and the remainder is eliminated by the urinary, salivary, and cutaneous channels. As it contracts the renal arteries, it hinders its own excretion by the kidneys, and, being rapidly absorbed, it may accumulate in the system if even a small dose is frequently repeated and continuously administered. It is much more poisonous when injected into the rectum than when swallowed.

The fatal dose is placed by Taylor at from $\frac{1}{2}$ to 2 grains for an adult, but recovery has taken place after larger doses—even 7 and 8 grains—cases probably of imperfect absorption, due, perhaps, to the presence of fat or tannin in the food in the stomach. A child, aged two years and a half, died in four hours from a dose of $\frac{1}{16}$ of a grain. After death from strychnine poisoning cadaveric rigidity is marked, with opisthotonos, clenched hands, and arms flexed across the chest, and the muscular rigidity may persist for several months after death. The face is usually pale, but sometimes livid, the internal organs are gorged with dark blood, and the bladder is usually contracted. The cause of death is primarily asphyxia, produced by rigidity of the muscles of respiration with possible factors in spasm of the heart or exhaustion thereof.

On animals strychnine acts as it does on man, but in different degrees; birds, guinea-pigs, and perhaps monkeys are comparatively insusceptible to it, while ruminant animals are less easily affected than other quadrupeds, at least when it is given by the mouth, and cats resist it singularly. Very minute portions in the soil will destroy the life of growing plants.

There is no very reliable chemical antidote, unless potassium permanganate should prove to be one, having been taken recently in large dose after the ingestion of $\frac{1}{4}$ of a grain of strychnine, without any symptom of strychnine poisoning resulting (Fahr). Tannic acid is the usual antidote, forming the tannate; another is iodine in dilute solution, or a soluble iodide. Animal charcoal should be given freely, also fats and oils, to retard absorption. Evacuation of the stomach should follow the administration of any antidote, and the bladder should

be emptied frequently, to prevent reabsorption.

Chloral, which is by far the most reliable of the antagonists, should be given as soon as possible, 30 grains at once, with or without potassium bromide, and repeated in doses of 20 grains at hourly intervals as long as reflex exaltation continues. Quiet, as perfect as possible, is an antagonistic measure of great value. Ice should be applied to the spine, and artificial respiration practised when possible. Hydrastinine hydrochloride, given hypodermically in the amount of a grain, has been successful. Nicotine has proved efficient in many cases, also tobacco by enema. Chloroform or amyl nitrite, by inhalation, may be used to procure muscular relaxation. Physostigma is antagonistic, but dangerous. Chamomile oil subdues reflex excitability in frogs poisoned by strychnine. Veratrum viride has cured a bad case; a fluid drachm of the tincture was given at once, followed by 2 drops every ten minutes (Ringer). Valerian mitigates the spasms. Curare, in doses of ¼ of a grain hypodermically, is warmly recommended, but its value is doubtful. Potassium bromide is antagonistic, but too slow of action to be of service.

Strychnine is antagonistic to chloral, physostigmine, and morphine, and may be used as a respiratory stimulant in poisoning by any of those drugs and in narcotic poisoning when respiration is failing.

Therapeutics.—Nux vomica has a wide range of therapeutic efficacy, though chiefly employed as a *stomachic tonic* and a *stimulant of the cardiac, respiratory, and other nerve-centres.* When some degree of its physiological action is desired, the salts of strychnine are preferred for administration, more accurate dosing being thereby attained, as the proportion of this alkaloid in nux-vomica preparations varies greatly. The tincture, in doses of 5 minims, is an excellent remedy for *flatulent dyspepsia* and *flatulency* of any kind, also for *pyrosis* and *gastric catarrh*, especially in drunkards, and is often efficient in the *morning vomiting of dipsomaniacs* and the *vomiting of pregnancy.* In the *vomiting of phthisis* strychnine is one of the best agents. The extract is much used in laxative pills for *habitual constipation*, with the object of increasing peristalsis, and in either *constipation* or *diarrhœa* due to *atony of the bowels* the tincture, in 10-minim doses, may be given with good results. In the condition clinically known as "*torpid liver*," wherein the stools are of a pale colour and an offensive odour, showing the absence of bile, the tongue is coated with a thick fur, and the patient complains of headache, lassitude, anorexia, and a bad taste in the mouth, small doses of strychnine ($\frac{1}{60}$ of a grain) twice or thrice daily will often act as well as a mercurial, restoring bile to the stools and correcting the other symptoms. *Epidemic diarrhœa* and *dysentery* are frequently controlled by it, and in *anæmia* and *chlorosis* it is an invaluable remedy, with iron and quinine. As an adjunct to the latter in intermittents it is generally useful, and has proved of decided service in tremors and *ataxic movements* of various kinds (but not in locomotor ataxia), also in *chorea*, *epilepsy*, and *idiopathic tetanus.* Strychnine is highly efficient in many forms of *neuralgia*, especially the *visceral* (*hepatalgia*, *gastralgia*, etc.), also in *infraorbital* and other *neuralgiæ* accompanying anæmia and general debility, in all of which very small doses ($\frac{1}{100}$ of a grain) should be employed. *Headaches* are often controlled by nux vomica, especially the *sick headache of gastric origin*, in which a minim of the tincture every ten minutes frequently gives marked relief; and doses of 10 minims before each meal will prevent *frontal headache* in many persons liable thereto. A sense of heat and weight on the top of the head, accompanied or not by flatulence, and occurring usually in women at the climacteric, will often yield to the tincture in doses of 5 minims before each meal.

Nux vomica is a most efficient remedy against impending *cardiac failure* from almost any cause. Even with the pulse imperceptible, the extremities cold, and death apparently imminent, the administration of a drop of the tincture every five minutes has frequently given renewed strength to the cardiac contractions after five or six doses, initiating an improvement which resulted in eventual recovery. It is an excellent remedy for *coughs*, even for those of phthisis, pneumonia, bronchitis, or emphysema, but is particularly efficient in *coughs of neurotic origin*, such as *periodical cough*, *night cough*, and the *paroxysmal laryngeal cough* without lung or bronchial symptoms, but characterized by a persistent tickling sensation in the throat. In all these, drop doses of the tincture frequently repeated are much more serviceable than larger doses at longer intervals. In *bronchial asthma* and that of neurotic origin—in the *dyspnœa of pulmonary affections*, and that with *palpitation of the heart in hysterical subjects*—in *irregular cardiac action* and *overaction of the heart*, in *functional anæsthesia*, *hypochondriasis*, *abdominal cramps*, the *nervous movements accompanying pregnancy*, *cold hands and feet* due to languid capillary circulation, *prolapsus ani* and *urinary incontinence in children*, and *paralysis of the bladder* in old people, small doses of strychnine or nux vomica frequently repeated are remarkably beneficial. In many of these affections the therapeutic action of the drug is unmistakably antispasmodic, illustrating the opposite effect of large and small doses of an active agent, a thoroughly established fact in many cases, though not of universal application.

Local paralyses of various forms are well treated by the hypodermic injection of strychnine into the substance of the affected muscles, and *diphtheritic paralyses* are almost invariably cured by its internal administration. It may be useful in *hemiplegia* when degeneration has not set in, and when the paralyzed muscles are completely relaxed; but it is of no avail in recent cases or when electrical contractility is lost. Its too early use in cerebral paralyses, especially when due to hæmorrhage, may do serious harm; and in the early stages

of organic spinal lesions it may be decidedly injurious, particularly if given in large doses. It should never be used in spinal paralysis when there are symptoms of congestion or inflammation of either the cord or its membranes. In *hysterical paralysis* and that caused by *lead* it is decidedly beneficial, and is highly efficient in that form which is limited to one or two groups of muscles, especially *infantile paralysis* of long standing, even when the atrophic process has gone so far as to greatly impair the electrical sensibility. Mr. Barwell employed in such cases a 2-per-cent. solution of the hydrochloride by injection into the substance of the paralyzed muscles, giving as much as $\frac{1}{8}$ of a grain at a dose in some cases, with remarkable success and without the occurrence of a single accident, either in his experience or in that of others subsequently (Phillips). The safety of this injection is explained by the concentration of the solution employed, which, being highly irritant, sets up a circumscribed inflammation, inclosing the poison and localizing its action. A much smaller dose in weaker solution, given hypodermically, would prove toxic. Strychnine is very useful in cases of nervous impairment of the sight, especially in *amblyopia* from lead, tobacco, or alcohol, and atrophy of the optic nerve, also in that due to functional disorders of the retina without apparent lesion, and in muscular asthenopia. In these affections it may be used internally, but is usually employed by injection into the tissues around the temple, beginning with $\frac{1}{60}$ of a grain, and gradually increasing the dose up to $\frac{1}{4}$ or $\frac{1}{8}$ of a grain. Improvement may not be apparent until the larger doses are reached.

[Strychnine is sometimes employed to remedy *defective uterine contractions during labour*. For this purpose the dose should be small; otherwise, there is danger of poisoning the fœtus. A Russian physician, Dr. Abrajanoff (*Jour. russe d'accoucheur. et de gynécol.*, 1895; *Presse médicale*, Feb. 5, 1896), having given to a woman in labour a subcutaneous injection of 0·015 of a grain of the nitrate, found that no sooner had he cut the umbilical cord, when the expulsive stage was over, than the child was attacked with opisthotonos and rigidity of the limbs, but the convulsion lasted only half a minute, and does not seem to have been repeated.]

A form of *amblyopia* termed by M. Sous (*Jour. de méd. de Bordeaux*) "*insolation*" *of the eyes* has been successfully treated by him with temporal injections of strychnine. The patient, a naval officer, had exposed his eyes for a rather long time to a very bright light while taking observations in mid-ocean at noon. Shortly afterward he noticed a marked trouble with his eyes, and in two months the visual acuity was 0·1 with central scotoma. The amblyopia was not of toxic origin. The affection made no progress after the first two months, and it might be considered as having been arrested, leaving only a certain inertia of the retina. Four drops of a solution of 1 part of strychnine sulphate in 200 parts of distilled water were injected in the left temporal region on the first day, and on the second day the same quantity was injected in the right temporal region. After the second injection the scotoma disappeared and the visual acuity rose. The injections were made alternately in each temple once a day, and they did not cause any pain. The sight rapidly became ameliorated, for after the eighth injection, the treatment having lasted for eight days, the visual acuity became normal.]

In acute and chronic *alcoholism* strychnine is undoubtedly of great service. In small doses it is signally effective for the morning vomiting and dyspepsia of drunkards, for the tremor of chronic dipsomaniacs, in the forming stage of delirium tremens, and in the depression due to enforced abstinence from alcohol. Hypodermically, in doses of from $\frac{1}{30}$ to $\frac{1}{60}$ of a grain of the nitrate, three or four times daily for a week, and less frequently for two weeks longer, it removes the craving for stimulants, counteracts the vaso-motor paralysis to which most of the injurious effects of alcohol are due, and is probably in other respects a true antagonist to the action of that narcotic poison on the human organism. The published reports of its efficacy in *dipsomania*, by Luton, Dujardin-Beaumetz, Portugaloff, and others, have been fully confirmed by recent observers, so that strychnine is now the acknowledged remedy for inebriety and the efficient constituent of the numerous "cures" therefor so widely advertised in the religious and secular press.

Strychnine arsenite possesses strong antiperiodic power, and may prove an efficient remedy for any *intermittent disease* rebellious to the influence of quinine. As it is highly toxic, the minimum dose should be given at first, and its effects carefully watched.

Brucine was formerly supposed to have an action analogous to that of strychnine, though weaker. The error arose from the fact that both alkaloids usually occur in commercial samples of the former one. Dr. Mays has, however, shown that pure brucine acts more like cocaine, being a powerful local anæsthetic in 5- to 10-per-cent. solutions on mucous membranes, and in a 20-per-cent. solution on the skin. In the latter strength it has been employed with satisfaction for *chronic pruritus*, and in a weaker solution (5-per-cent.) for *inflammations about the external ear*, in which Dr. Burnett alleges for it more satisfactory action than is obtained with cocaine.

Methyl-brucine and *methyl-strychnine*, like methyl-thebaine, do not affect the spinal centres, but paralyze the end-organs of the motor nerves, like curare, and may be used as antagonists in strychnine poisoning.

[Much attention has lately been paid in Australia and in India to the use of strychnine as a remedy for *snake poisoning*. Dr. August Mueller, of Yackandandah, has been a prominent advocate of its efficacy. In 1893 Dr. Mueller published a pamphlet on the subject in which he upheld the theory that snake venom acted by depressing and more or less suspending the function of the motor-nerve centres, and urged the use of strychnine hypodermically

in sufficient quantity to overcome the influence of the venom. For many months before the issue of that publication Dr. Mueller had repeatedly published accounts of cases observed by himself and others tending to show the life-saving properties of large doses of strychnine in snake poisoning, and several other physicians had confirmed his observations. So much vogue did Dr. Mueller's views obtain, and so many venomous snakes are there in Australia, that the instrument-makers of Sydney set to work to provide medical practitioners with specially designed "snakebite antidote pocket-cases." In the literature of the subject that has since arisen much has been published in criticism of Dr. Mueller's ideas, and the reported recoveries with which he supports them have been "explained away" with one supposition after another, so that it can not yet be affirmed positively that strychnine is a remedy to be fully relied on in cases of snakebite; nevertheless, it should be tried for want of a better one, although the large doses said to be necessary call for the utmost caution. In one case, that of a girl, twelve years old, $\frac{1}{15}$ of a grain was injected twice within ten minutes; in another, that of a person that had been bitten by a tiger snake, ten injections of $\frac{1}{10}$ of a grain each were given.

A reciprocal antagonism has been supposed to exist between strychnine and serpent venom, and thus has been explained the survival of persons so dosed with strychnine, and not only their survival, but also their freedom from symptoms of strychnine poisoning. So far as the poison of the cobra is concerned, the validity of this theory—indeed, the soundness of the strychnine treatment of cobra poisoning—has been rendered very doubtful, to say the least, by Surgeon-Lieutenant R. H. Elliot, of Madras (*Trans. of the South Indian Branch of the Brit. Med. Assoc.*, Oct., 1895), who has subjected the matter to careful experimental investigation. Dr. Elliot describes a number of antidotal experiments made with strychnine in cases of cobra poisoning, and says that out of the whole number, thirty-three, he has not one single case of recovery to record; that in no case did the strychnine save life. Much, he says, must be allowed for the individual idiosyncrasies of animals, nevertheless he thinks that, given an animal with a poisonous dose of cobra poison, the subcutaneous injection of strychnine often hastens death very noticeably, while it can not be said to retard it materially. It would seem, he says, that death may be hastened by the strychnine in two ways: 1. By its increasing the force and speed of the circulation, thus aiding the diffusion of the virus. 2. By the exhausting reaction which strychnine undoubtedly produces on the nervous centres. The author adds that he believes that the supposed antidotal action of strychnine in cobra poisoning is a delusion and a myth. On comparing the strychnine check experiments with the antidotal experiments, he says, the following facts will be observed: 1. That symptoms of strychnine poisoning manifest themselves as early after the injection of strychnine in the one case as in the other. 2. That in the early stages the convulsions of strychnine are as violent in the one case as in the other. 3. That in the later stages animals die from cobra poison with typical symptoms, and yet the least touch evokes an undoubted strychnine tremor in the animal up to within a minute of death. An intermediate stage occurs in which the victim starts on the least touch or sound, but does not respond with a convulsion. 4. That under the influence of a poisonous dose of strychnine the animal dies as surely when fully under the influence of cobra poison as it does when no such poison has been given. 5. That in some cases strychnine administered in physiological doses seems actually to determine at once the impending fatal issue. That in an animal poisoned with cobra virus strychnine may produce a temporary stimulation, and so may give rise to a fallacious appearance of improvement.]

The dose of nux vomica in substance, a form in which it is rarely used, is $\frac{1}{2}$ a grain, and not more than 3 grains should be given in the course of twenty-four hours. The dose of the extract, *extractum nucis vomicæ* (U. S. Ph., Br. Ph.), *extractum strychni* (Ger. Ph.), is from $\frac{1}{8}$ to $\frac{3}{4}$ of a grain, and not more than 2 grains should be given in a day. The dose of the fluid extract, *extractum nucis vomicæ fluidum* (U. S. Ph.), is from 1 to 5 minims. The dose of the tincture, *tinctura nucis vomicæ* (U. S. Ph., Br. Ph.), *tinctura strychni* (Ger. Ph.), is from 5 to 20 minims. The British solution of strychnine hydrochloride, *liquor strychninæ hydrochloratis* (Br. Ph.), is made with 1 part of strychnine, 2 fl. parts of diluted hydrochloric acid, 24 fl. parts of rectified spirit, and 73 fl. parts of distilled water; the dose is from 1 to 5 minims.—SAMUEL O. L. POTTER.

OAK BARK, *quercus cortex* (Br. Ph.), *cortex quercus* (Ger. Ph.), is the dried bark of the smaller branches and young stems of *Quercus Robur*. The Br. Ph. demands that the collection shall take place in the spring, and shall be made from trees which grow in Britain. The drug as found in pharmacy is in quills which are covered externally with a corky layer of grayish colour, and which internally are brownish and longitudinally striated. It has little or no odour, but its taste is very astringent. White-oak bark, *quercus alba* (U. S. Ph.), is the bark of *Quercus alba*, an oak which grows in the United States, and closely resembles the oak of Great Britain. It occurs in nearly flat pieces, which have been deprived of the corky layer; its colour is pale brown, it has a faint odour like that of tan, and its taste is highly astringent. In the shops it is kept as a coarse, fibrous powder. Among the constituents of oak bark are tannic acid, gallic acid, and extractive. The tannin is the important ingredient. It is of the variety known as *quercitannic acid*. It varies much in amount according to a number of circumstances, among them the part of the tree from which the bark is obtained and the season

when it is gathered. It is especially abundant in the young bark, and the bark contains far more of it in the spring than at other seasons. The requirements of the Br. Ph. are thus explained. A bitter principle called *quercin* is also found in oak bark.

Oak bark is highly *astringent* and somewhat *corroborant* by virtue of its bitterness. It is ordinarily employed in the form of decoction, *decoctum quercus* (Br. Ph.). This is composed of 1½ oz. of bruised oak bark and 1 imperial pint of distilled water. These are boiled for ten minutes, strained, and sufficient distilled water is added through the strainer to maintain the quantity at 1 pint. The dose is from 1 to 2 fl. oz. It may be given in those *diarrhœal conditions* in which astringents are not contra-indicated, but it is far more commonly used as an external remedy. It may be employed as an injection in *leucorrhœa*, as an enema in *hæmorrhoids*, as a wash in *prolapsus ani*, and as a gargle in *relaxation of the fauces and uvula*. It has even been thought beneficial as a bath, especially for use in children, in such conditions as *marasmus* and *chronic diarrhœa*. As a local application, too, it is beneficial in *flabby ulcerations* and *hyperidrosis*.

Black-oak bark is the bark of *Quercus tinctoria*. Its properties are similar to those of the barks already described, but it contains a colouring matter, *quercitrin*, which is soluble in boiling water and turns it brown. A decoction of black-oak bark is therefore objectionable because of its staining qualities, and is seldom used.—HENRY A. GRIFFIN.

OATMEAL.—This is chiefly used as an article of diet, being nutritious and easily digested by most persons who have passed the age of infancy. It is slightly *laxative*, and is therefore a particularly appropriate food for individuals affected with *chronic constipation*. It is thought, however, to have a tendency to add to the irritation of the skin in cases of eczema, and to aggravate the disease. Oatmeal gruel is a suitable article of food in the early days of convalescence from inflammatory and febrile diseases.

ODONTINE.—This name has been applied to various dentifrices and antodontalgic preparations. According to Geissler and Möller (*Real-Encyclop. d. ges. Pharm.*), *English odontine* is composed of

Camphor	5	parts;
Alcohol	10	"
Chloroform	20	"

Or of

Oil of cajuput	2	parts;
Oil of cloves, each	3	"
Oil of juniper, each	3	"
Ether	24	"

These are for use in cases of *toothache*. A bit of cotton moistened with either of them is to be inserted into the cleansed cavity of the tooth in cases of *caries*.

ODONTODOL.—This is a name given in Italy to a new preparation which is much vaunted in the treatment of *toothache*. The formula is as follows:

Cocaine hydrochloride, each	15	gr.;
Oil of cherry-laurel, each		
Tincture of arnica	150	"
Solution of ammonium acetate	300	"

If the pain is caused by *caries*, a piece of cotton saturated with the liquid is put into the cavity of the tooth; if it is caused by *inflammation of the pulp*, the mouth should be washed out with odontodol diluted with twice its bulk of warm linseed tea. If the pain extends to the entire jaw, the painful surface should be thoroughly rubbed with several drops of odontodol, after rinsing the mouth with the solution. Care should be taken not to swallow any of the odontodol.

OILS.—These are liquids or solids, generally of a greasy or fatty character, often distinguished by a peculiar odour, more or less viscosity, insolubility in water, and affinity for the most volatile solvents. These bodies occur in the three kingdoms of Nature, but vary so much in their properties that no general definition can apply to them all. In fact, the word "oil" is merely a conventional term which is often misapplied to substances entirely foreign to the group of true oils.

Oils are most conveniently divided into three classes—namely, *mineral*, *fixed*, and *volatile* oils, though these terms, when strictly interpreted, partly overlap each other. However, custom has drawn the limits of each so sharply that there is no probability of any confusion arising.

Mineral oils are usually hydrocarbons derived from the carboniferous deposits of former geological ages, the most familiar representative of which is petroleum. This is itself a most complex body, but it interests us here only so far as its oily character or its oily constituents are concerned. Crude petroleum contains a number of substances which are very volatile and the removal of which causes the residue to assume more and more an "oily character." This is particularly shown by the fact that when a portion of this residue is dropped on blotting paper the oily stain remains for a long time. Mineral oils are all more or less volatile, the boiling point increasing with their density. Their chief characteristic is that they can not be saponified.

Mineral oils or fats—the latter term being applied to those of a more or less solid consistence—are largely employed in medicine, particularly as vehicles for remedial agents. Very carefully purified fractions of American or Russian petroleum (liquid vaseline, albolene, etc.)—entirely free from odour or taste—are used, for instance, in spraying the throat or nasal passages. The unctuous residue, left on distilling off the more volatile fractions from petroleum, when properly purified, is extensively used as an ointment or ointment base under the name of *petrolatum*, or vaseline, and crude petroleum itself is still in considerable use for embrocations, particularly in domestic practice. It also constitutes one of

the most efficient parasiticides when freely applied to the infested parts.

Fixed oils are derived from the animal and vegetable kingdoms. These bodies are usually compound ethers (esters) of glyceryl and one or more of the so-called fatty acids. The most commonly occurring fatty acids are stearic, palmitic, and oleic. The more oleic acid an oil contains, the more fluid it is at the ordinary temperature, and the less liable it is to congeal when cooled. The preponderance of palmitic, and still more so of stearic acid, causes the oil to be semisolid or solid. When fixed oils are heated with water and an alkali, the fatty acids combine with the latter, and the glyceryl, C_3H_5, is converted into glycerin, $C_3H_5(OH)_3$, a portion of the water being consumed in the reaction. This is called saponification. When a portion of a fixed oil is dropped on blotting paper it leaves a greasy stain which does not evaporate when heat is applied.

Volatile oils are derived almost exclusively from the vegetable kingdom. They may be subdivided into hydrocarbon oils, oxygenated, sulphuretted, and nitrogenated oils. The hydrocarbon oils, or terpenes, mostly have the composition $C_{10}H_{16}$. Oil of turpentine (rectified) is a type of this class. Among the oxygenated oils there are many possessing a highly aromatic odour, which is chiefly due to the oxygenated constituent. Most of them are not simple bodies, but consist of several, one of which is very often a terpene, and this is usually not the bearer of the odour. Examples of oxygenated oils are oil of cinnamon, cloves, peppermint, wintergreen, etc. The sulphuretted oils contain sulphur, and possess a pungent, disagreeable odour and taste. Examples are oil of garlic and oil of mustard. In the case of mustard the volatile oil does not preexist in the plant, but is formed by the action of water on the constituents. Nitrogenated oils are those which contain the group CN, cyanogen. Such are oil of bitter almonds, oil of peach-kernels, etc. In these the cyanogen compound is likewise formed only after the kernels have been macerated with water.

Fixed oils are obtained either by melting or heating the substances containing them or by pressure, with or without heat. Volatile oils may all be obtained by distillation, usually in a current of steam, which enables them to be volatilized at a temperature far below their own boiling points. Some of them may also be extracted by mechanical means, in the cold, such, for instance, as the oils of orange, lemon, and bergamot, which are thus obtained of a much finer flavour than would be possible by distillation.—CHARLES RICE.

OINTMENTS.—These are fatty preparations, softer than cerates, and intended, as a rule, to be applied by inunction. Some of them, however, are preferably spread on some fabric and applied in this manner. They consist either altogether of fatty, or a combination of fatty, resinous, waxy substances, etc.; or else of a mixture of these with some active medicinal ingredient.

Ointments of a compound nature are made either by melting the ingredients together or by incorporating them mechanically; in one case (*unguentum hydrargyri nitratis*) also by the aid of a chemical reaction. In combining the ingredients of an ointment by fusion, as low a degree of heat should be used as will accomplish the object, and, unless the constituents are by nature perfectly and homogeneously diffusible into each other (such as oils with lard or suet, resin with lard, etc.), the mixture must be stirred while cooling, to prevent the separation of one or another of the ingredients. When a solid insoluble in the fatty base is to be incorporated it should be in the state of finest powder. This should first be rubbed with a small portion of the ointment-base until a perfectly smooth paste is formed, after which the remainder of the base may be incorporated. When solid extracts (for instance, extract of belladonna or of stramonium) are to be mixed with an ointment base, they should first be rendered semifluid by trituration with water or diluted alcohol, as the case may require.

On a small scale, ointments are best prepared by trituration or rubbing on a marble slab or glass plate with a flexible spatula or an ointment trowel, since the degree of homogeneity and the absence of gritty particles can be best seen when the ointment is spread and drawn to and fro in thin layers across the surface. Mortars are not so suitable, since only a small portion of the mass will be acted on by the face of the pestle at a time, while the remainder will be forced up on the sides of the mortar and the stem of the pestle. Very smooth ointments may be produced by employing a mechanical mill, such as that used by manufacturers of paints and colours. For operations on a small scale, one of the best ointment mills is that made by Liebau, of Chemnitz, Germany.

The ointment bases most generally in use are lard, mixtures of a bland oil with wax, spermaceti, resin, etc., mixtures of suet and lard, etc., wool-fat in its various forms, and unctuous substances derived from petroleum. These bases must be perfectly bland and neutral—that is, free from fatty acids (the cause of rancidity) and other irritating constituents. It is customary to impregnate lard and other fatty substances used in ointments with certain preservative agents, usually benzoin, to prevent or retard the change which produces the rancidity.

Sometimes the bland ointment base is used by itself for inunction, the object being merely to exclude the air from the skin, without using any specific medication. Usually, however, ointments are mixtures of fatty bases with medicinal substances which are intended either to act purely topically—that is, on the surface to which they are applied; or topically and physiologically—that is, by absorption into the circulation.

The more affinity an ointment base exhibits toward water, the more easily will it be absorbed by the skin; and the more it repels water, the less probably will it be absorbed.

The hydrocarbon fats (petrolatum, vaseline, etc.) belong to the latter class. Wool-fat (which consists chiefly of the cholesterin ether of glyceryl) in any of its commercial forms, such as lanolin, adeps lanæ hydrosus, etc., is the best representative of the former. Indeed, lanolin is so readily absorbed by the skin that an insoluble substance, such as zinc oxide, with which it is mixed, is apt to remain as a dry crust on the skin some time after the ointment has been applied. By combining wool-fat with other fats in proper proportion its rate of absorption may be retarded at will.

Professor Unna has introduced a method of applying ointments to the skin in the form of soft plasters, termed "ointment-mulls" (*Salben-mull*), that is an absorbent fabric (absorbent gauze) on which the ointment is spread under certain precautions. These mulls may be prepared in the following manner:

A piece of parchment paper larger than the piece of gauze or mull is wet and spread upon a level surface, and all superfluous water wiped off. The piece of absorbent fabric (mull) is now fastened upon it with pins or tacks, and the ointment, which must be but slightly warm, is spread upon it as uniformly as possible with a flat brush at least three inches in breadth. The surface is then smoothed rapidly by means of an elastic spatula which is immersed in hot water, quickly wiped, and drawn across the ointment. It is best to put several spatulas at once into the hot water, so as to lose no time after the first one has cooled. When the ointment has been smoothly spread, one edge of the fabric is attached to a straight stick, and the whole piece detached from the paper, covered with paraffin, and hung up for a few hours in a cool place, when it may be rolled up. For use, a suitable piece is cut off, applied to the affected part, covered with paraffin paper, and secured by a bandage or otherwise.—CHARLES RICE.

OLEANDER.—See under NERIUM.

OLEATES.—See under OLEIC ACID.

OLEIC ACID.—Pure oleic acid, when fresh, is a colourless liquid of an oily consistence, without odour or taste, and possessing, in alcoholic solution, a neutral reaction. It is very easily oxidized when exposed to the air, turns brown, and acquires an acid reaction and a rancid odour. When cooled, it congeals to a white crystalline mass which becomes liquid again at 57° F. This substance is of interest rather to the chemist than to the physician or pharmacist, yet it is the chief constituent of the commercial oleic acid, which is used in medicine.

The oleic acid of the pharmacopœias, *acidum oleicum*, is obtained in the process of decomposing fats, as carried out in various technical operations (such as the manufacture of stearic acid, candles, etc.). It is the acid derivative of olein, a widely distributed fatty ether of glyceryl, which is fluid at ordinary temperatures, and the presence of which in a mixture of fats causes the latter to be more fluid than would otherwise be the case. The liquid removed by pressure from stearic acid, in candle-works, is technically called red oil, is of a deep red-brown colour, and has a peculiar, disagreeable, fatty odour. It contains, besides real oleic acid, a considerable quantity of stearic acid and often some of the intermediate fatty acid (such as margaric). To free it as far as possible from these, it is carefully cooled to about 39° F., so as to cause the stearic and margaric acids to solidify; the mixture is then subjected to gradually increasing pressure in suitable bags, and the liquid portion repeatedly treated in the same manner until there is no longer any sign of congelation on cooling the liquid.

Oleic acid of a lighter tint, and more easily freed from the solid fatty acids, may be obtained by decomposing an olive-oil soap (Castile soap) by sulphuric acid, treating the separated fatty acids by cold and pressure, as just described, and washing the liquid residue with warm water. It may be obtained in a still purer condition by combining the product thus obtained with oxide of lead, dissolving the warm oleate of lead in 10 parts of benzin, and decomposing this solution by diluted hydrochloric acid. On evaporating the benzin, the oleic acid will be left behind.

It is stated that commercial oleic acid is very commonly adulterated with linoleic acid (from linseed oil), which has different properties. The presence of even 1 per cent. of this may be detected by treating the saponified oil with permanganate of potassium, which converts oleic into azaleinic acid, while linoleic is converted into sativic acid. On decomposing the soap with a mineral acid, and treating the separated fatty acids with ether, the azaleinic acid will dissolve, but the sativic will not.

Oleic acid is used in medicine only as a vehicle or solvent of certain remedies. Some of these are intended to be absorbed, while others are not. The vehicle itself, however—that is, the oleic acid—is quite easily absorbed by the skin, much more so than a neutral fat.

Oleic acid is a good solvent of alkaloids and of many metallic oxides, such as oxide of mercury, copper, zinc, etc. On triturating these substances with some of the oleic acid so as to bring every particle in contact with the liquid, and then macerating or digesting for some time, complete solution may be effected. In preparing the so-called "oleates" in this manner, the intention is to have an excess of oleic acid present in which the real chemical compound, the true oleate, is kept in solution or with which it is mixed. The oleates, prepared in this manner, which are in more than ephemeral use are the following:

Oleatum hydrargyri (U. S. Ph.), made by dissolving 20 parts of oxide of mercury in 80 of oleic acid. For use, this is often diluted with oleic acid, so as to reduce the percentage of oxide of mercury to 15, 10, or 5 per cent., or even less.

Oleatum veratrinæ (U. S. Ph.), which contains 2 per cent. of veratrine.

Oleatum zinci (unofficial), of 5, 10, and more per cent.

Oleatum atropinæ (unofficial), of 1, 2, or more per cent.

Oleate of aconitine was at one time praised as a very efficient agent in neuralgia, but has been found too risky for general use.

True oleates may be prepared by double decomposition between the solution of an oleic-acid soap and the solution of a metallic salt. The resulting precipitate, for instance, oleate of lead, of copper, of bismuth, etc., when thoroughly washed and dried, is usually in the form of a dry, hard mass or in dry powder. These oleates are either used, by themselves, as dressings, or are combined with fatty bases, and applied as ointments.—CHARLES RICE.

OLEORESINS.—As the name implies, these are compounds of oils and resins. The word "oil" in this connection is to be taken in the sense of "volatile oil." In pharmacy the term is applied to preparations made from vegetable drugs containing an essential oil and a resin which are medicinally active, more particularly such as are of a pungent, spicy character.

Oleoresins may be prepared by various volatile menstrua, such as benzin, ether, chloroform, etc., but ether is the one usually employed, as it is the easiest to be removed from the product without leaving its own taste behind. Owing to the volatility of the menstruum, it is preferable to employ some form of apparatus which will prevent too great a loss of ether by evaporation. This is best accomplished by connecting the percolator in which the exhaustion of the drug by ether is effected air-tight with the receiver, establishing a communication between the air-spaces of the two vessels by a separate connection (tubing). As fast as the ether percolates through the drug and drops, loaded with dissolved matters, into the receiving vessel below, the air displaced in the latter is transferred to the percolator. In the manufacture of oleoresins on a large scale special precautions are taken, by means of suitable condensers, to diminish the loss of ether to a minimum.

The oleoresins which are official in the U. S. Ph. are the following:

Oleoresina aspidii, formerly called *oleoresina filicis* (oleoresin of aspidium or male fern; very commonly called simply "oil of male fern"). This is prepared by exhausting the green parts of the rhizome of male fern, previously powdered, with ether. From the percolate the greater part of the ether is removed by distillation on a steam-bath, and the residue is then exposed to the air until the remaining ether has evaporated.

This oleoresin has the peculiar property of gradually depositing a granular-crystalline precipitate which consists of filicic acid, the most active principle contained in the drug. Ignorant pharmacists are apt to regard this as an inert matter, such as will often form in tinctures containing pectin bodies, and they are anxious to get rid of it by filtration or otherwise. In the present case the sediment should be carefully incorporated with the liquid portion before any of the oleoresin is removed for use.

Oleoresina capsici, oleoresin of capsicum, is prepared in the same manner. When the ether is finally evaporated a considerable amount of a waxy substance will be found mingled with the liquid oleoresin. In order to get rid of this, it is best not to evaporate until all traces of ether vapour are gone, as the mixture will then usually be too thick to be strained. If it is strained while yet just sufficiently liquid, the waxy constituent may be completely separated.

Oleoresin of capsicum is the most concentrated pharmaceutical preparation of the drug, and must be employed with caution. It is used externally, spread in a thin layer upon adhesive plaster as a *rubefacient*. For internal use it must be largely diluted with other substances.

Of the other official oleoresins, that of cubeb is employed in making troches or pastils of cubeb. The remaining ones—viz., those of lupulin, pepper, and ginger—are but little in use.—CHARLES RICE.

OLEUM CADINUM (U. S. Ph.)—Oil of cade (see under TAR).

OLIBANUM, or frankincense, *thus americanum* (Br. Ph.), is a gum-resin which enters largely into the composition of incense, on account of its yielding, when burning, a fragrant odour. In medicine it has essentially the same effects upon the respiratory mucous membranes as the other gum-resins and may be substituted for balsam of Peru and balsam of Tolu in the treatment of *bronchitis*, etc. The fumes arising from its slow combustion or those furnished by exposing it to heat are recommended in *chronic bronchitis* and *laryngitis*, on account of their slight stimulant effects. Combined with charcoal, saltpetre, and a little gum, it forms pastils which are sometimes burned to disguise unpleasant odours in sick-rooms, etc. The dose of olibanum ranges from 15 to 60 grains, and it is recommended to combine with it a little soap, which is believed to add to its activity.

RUSSELL H. NEVINS.

OLIVE OIL, or sweet oil, *oleum olivæ* (U. S. Ph., Br. Ph.), *oleum olivarum* (Ger. Ph.), is a bland oil obtained by expression from the fruit of the *Olea europæa*, a native of the countries bordering upon the Mediterranean but cultivated in nearly all the semi-tropical countries of the world. It is almost entirely without odour, has a sweetish taste, and is yellow or greenish-yellow in colour, the oil of the latter colour being the most delicate and highly prized, but rarely met with outside of the regions in which it is produced. Varieties less commonly met with are dark-coloured and are used almost exclusively in the manufacture of soap, plasters, etc. When exposed to the action of the air and light, olive oil rapidly becomes rancid, assumes a darker colour, and acquires an unpleasant taste and odour. After its exposure to a temperature slightly below that of freezing it solidifies into a mass of about the consistence of soft butter, and at slightly higher temperatures is apt to become turbid on account of the separation of small particles of palmatin and stearin. This con-

dition often leads to the suspicion that the sample has been sophisticated, but slight agitation and warmth will cause the oil to become perfectly clear. When kept in tightly closed vessels it will remain sweet for long periods; but when once exposed to the air it should be used at once or kept in a very cool place, such as a refrigerator. It is more than probable that little of the olive oil consumed outside of the countries in which it is made is free from adulteration, but the only important adulterant and the one most commonly employed is cotton-seed oil, and, provided the latter is pure and sweet, the principal objection which can be urged against the sale of the sophisticated article is that it is a fraud upon the consumer. From nearly every standpoint cotton-seed oil is as desirable as olive oil, but lacks in a measure the delicate flavour of the finer grades of the latter.

Olive oil is largely used in pharmacy in the preparation of liniments, cerates, and ointments, but has been almost entirely replaced in the U. S. Ph. by cotton-seed oil, which is equally useful and much cheaper. For the preparation of salads olive oil, or what is commonly so termed, is oftener used than cotton-seed oil; but for all other purposes in cooking it is no better, although more expensive. For inunction and for the protection of *raw surfaces* it is less suitable than cacao butter or vaseline, as it becomes rancid very quickly and the fatty acids developed are irritating to the skin. In all *wasting diseases* it forms a valuable addition to the food, as it may be incorporated into salads of various kinds and will not usually be regarded by the patients as a necessary element in their treatment. In conditions in which a fatty food is imperatively demanded cod-liver oil is to be preferred, for the reasons mentioned under that head. Like nearly all fatty bodies, olive oil is *laxative* and may be used as such in doses of from 1 to 2 fl. oz., but it is not very efficient and its use is almost limited to children and infants. It may be added in almost any proportions to enemata when there are large *accumulations of hard fæces* in the rectum, but, while it undoubtedly softens them, it is not so efficient as linseed oil, which has in addition an irritant effect upon the rectum. As large amounts as can be taken without exciting nausea are reputed to increase the quantity and fluidity of the bile, and consequently to be of use for the relief of *biliary calculi*.

[The olive-oil treatment of *biliary colic* is regarded by some physicians as one of very great efficiency; others consider it of no value. The question must be regarded as still unsettled. Professor Combemale, of Lille (*Bull. méd. du Nord*, July, 1893; *Gaz. méd. de Paris*, Sept. 23, 1893), who seems to have no doubt of its value, finds a similitude between biliary colic and *lead colic;* hence he has been led to try large doses of the oil in the treatment of painters' colic. He reports four cases of its successful employment, and thinks it is in some respects superior to other remedies for this form of plumbism.]

RUSSELL H. NEVINS.

OPIUM.—It is, of course, impossible to detail all of the countless therapeutic applications of opium. It will therefore be the aim of the writer to deal with the general principles which underlie the use of this drug rather than to summarize all the detailed uses to which it might be applied. In the first place, its power to support life as a *substitute for food* is of great value, as is also its power to contribute to the support of the body as an auxiliary to food. Millions of well-to-do, sober, and industrious Orientals take their opium daily as the European takes his wine—as a sort of supplementary food. This they do with no more thought of dissipation than we have in smoking a cigar, and oftentimes with less damage. Taken in this way, indeed, it seems to entail no evil consequences, and it does not cause narcosis.

In this country there seems to be an increasing number of those who take opium as most do alcohol, simply to remove fatigue or to add to a too slender food allowance. The food-power of opium is certainly great, and in circumstances of privation it has been shown to exist for horses as well as for men. It is not intended to intimate that opium is in any sense a tissue-builder, but merely that it serves the clinical purpose of making the lack of food less disastrous. It is of controlling importance that one should bear in mind the danger of forming the opium-habit by any avoidable use of the drug, but it is only fair to admit that great benefit has followed its use in cases of *profound enfeeblement* due to deprivation of food, or loss of sleep, or fatigue from excessive exertion. In such conditions food and rest would be the natural restoratives to apply, but without question recovery is more rapid if small amounts of opium are given, or perhaps preferably small doses of morphine, such as a fifteenth or a tenth of a grain. The only obvious effect of such doses is a general addition to the patient's comfort and to his power of repair. It is extremely important that large doses be not given. The slightest development of narcosis, being followed, as it invariably is, by reaction, would be very harmful.

Another illustration of its restorative power is in *prostration from severe hæmorrhage.* It is within the experience of many surgeons and obstetricians that after severe hæmorrhage opium in full doses seems to sustain life until food can be assimilated in a way superior even to alcohol. Under these circumstances both these agents are well borne and in large doses, and seem to cause no other effect than the removal of certain grave symptoms, such as rapidity and feebleness of the heart, restlessness, delirium, wakefulness, etc. Of the two, opium is the more useful in this condition.

It is impossible to say what the exact doses should be; it should be given in small amounts and at frequent intervals until it produces the desired effect, but it is very important to avoid narcotism. The *modus operandi* is entirely unknown, but it is known that the induction of narcotism is fraught with great danger.

In *hæmoptysis* which is at all profuse opium is of value, as it is in all cases of severe hæm-

orrhage, but it is of special value in small bleedings with nagging cough which seems to keep up the bleeding. The use of opium diminishes the cough, and this is often followed by cessation of the bleeding. It is far more useful in this condition than all the real and imaginary styptics.

In the *hectic fever of phthisis* it often gives great comfort by relieving the irritating cough that is so distressing.

In *hæmorrhage from a typhoid ulcer* it is of great value, not only on the general principles above enunciated, but because it allays the patient's apprehension and puts him at rest, and thus tends to immobilize the bleeding point. By this means the danger of a recurrence of the bleeding is reduced to a minimum.

In the *irritable restlessness* due to prostration of prolonged and enfeebling diseases, such as protracted fever or suppuration, its effects are often highly beneficial. In this condition only small doses are required, and unless there is some contra-indication, it is best administered subcutaneously.

Who does not recognise the condition? A feeble, rapid pulse, great general weakness and depression associated with delirium, muscular tremors, picking at the bedclothes, a dry, brown, shaky tongue—these are its prominent symptoms, and among them stand out conspicuously wakefulness and delirium. The administration of from a tenth to a quarter of a grain of morphine subcutaneously will often be followed by a calm, quiet, restful sleep, after which great improvement in the general condition may be observed.

If *diarrhœa* is excessive in *typhoid fever*, and especially if it is associated with delirium, we have a double indication for the administration of the agent.

It is a fact, so far as I am aware, without exceptions that there is absolutely no danger of engendering the opium habit by its use in this latter condition; and, incidentally, the same may be said with regard to alcohol. Indeed, these two agents are usually to be used jointly in these conditions, and such use is likely to produce better results than the use of either alone.

Although the above-mentioned small doses will usually be sufficient, the therapeutist must never forget that he is using opium here to accomplish a definite effect, and that this necessarily implies a somewhat indefinite dose. It must be given in divided doses until it produces the effect that is sought.

It is extremely important here again not to narcotize the patient.

In *collapse due to cholera* it has been found very beneficial. Here, of course, opium *per os* would be useless, because of the greatly diminished absorption that takes place. Its trial in this condition seems to have been carefully undertaken in the British Seamen's Hospital at Constantinople. A dose varying between a quarter and half a grain was followed in numerous instances by a quiet sleep, after which recovery usually took place. Occasionally the same patient needed to have this dose repeated two or three times. There has been a disposition to elevate this to the height of a method of treating cholera—a contention for it which is absurd. That certain symptoms of the stage of collapse may be benefited by it may well be allowed.

It is in *heart disease* that opium achieves its most significant modern victory.

In speaking of the general subject I have used the words opium and morphine interchangeably, but I should like to be understood as having a decided preference for morphine, as a rule, and as using this by subcutaneous injection in the absence of contra-indication.

The recommendation to use morphine in heart disease came from England. It is a singularly apt illustration of the great benefit to be obtained from an accurate clinical knowledge of the action of the agent which no amount of laboratory study or research could have rendered possible; and, moreover, it is an illustration of the value of the subcutaneous injection of this alkaloid which can not be replaced by mouth administration of the same alkaloid or of opium. Opium given by the stomach is not suitable in the distress of most forms of heart disease.

It is especially in late stages of *mitral stenosis* and *mitral insufficiency* that morphine, given subcutaneously, accomplishes such happy effects. Here we see all the appearances of general venous congestion. It begins, of course, in the lungs and extends thence to the entire body, manifesting itself by cyanosis, pallor, and dropsy. The heart may be unduly active, even tumultuous in its effort to overcome the mechanical impediment to the circulation, and the patient may be slowly suffocating in consequence of the inability of the blood to convey the needed oxygen to the tissues. Anything at all approaching narcosis would further aggravate the existing congestion and general distress. But a non-narcotic dose of morphine, given subcutaneously, has a totally different effect. An eighth of a grain or double that amount seems to restore the disturbed balance in the circulation, and most of the distressing symptoms are thus ameliorated. The face becomes less turgid, the expression calmer, the precordial distress disappears, the pulmonary congestion abates, the heart becomes more tranquil and regular, and the patient may enjoy the refreshing influence of a tranquil sleep.

The effect is certainly better in mitral than in aortic disease, and yet in parallel cases of aortic disease we need not fear to use it in the same way.

In *angina pectoris*, if the pain is severe, it will sometimes yield to no other treatment, although it is proper first to try the arterial dilators in this condition. In some of these cases it seems to exercise a lasting influence over the symptoms. In old cases of this distressing condition the severe paroxysms of pain are not always associated with arterial spasm and increased arterial tension, and in such cases the use of the nitrites is not indicated.

In another form of *dyspnœa* it will often serve an exceedingly useful purpose. In con-

ditions of *laryngeal stenosis* caused by inflammatory swelling, by croup, or by diphtheria, it will often cause a very marked subsidence of the dyspnœa and its attendant distress. For a child a year old doses of two drops of the deodorized tincture, for older children larger doses, up to five drops, given two, three, or more times a day, have often been followed by an amelioration of the dyspnœa with all its attendant symptoms of distress. In some cases this treatment will replace operative procedure; in others it will enable one to postpone an operation. Even this is often a great gain.

In *diabetes* codeine and morphine will sometimes exercise a controlling influence over the amount of urine, as well as over the sugar percentage, and many of the much more distressing symptoms of this grave malady. Neither of these alkaloids should be administered in narcotizing doses for this purpose, and one need entertain no hope of being able to cure the disease by this means.

For the cure of *pain* opium is without a rival. In general, it is better administered subcutaneously for this purpose. It is not necessary to narcotize a patient in order to cure his pain; in fact, the relief of pain is exceedingly common even without the production of sleep at all.

It is of great importance to give the smallest dose that will accomplish the purpose, for many reasons. Anything resembling narcosis is very objectionable on numerous accounts, but particularly because it is likely to be followed by a condition of depression which makes one distinctly less able to endure pain. If large doses are used there is much more danger of establishing the opium-habit. To relieve pain the doses to begin with should be from a fifteenth to a sixth of a grain of morphine. If the pain is due to a chronic condition or to one that is to recur frequently, it is exceedingly desirable not to use opium in its relief at all, of course; but in the pains of acute conditions, such as acute inflammations, it is of immense value.

Once in a great while a case may occur in which it will be necessary to narcotize a patient in order to relieve his pain. This is true occasionally in the pain due to ulcerations of malignant disease involving sensitive nerves, as it also is in some of the painful conditions due to pressure, as by brain tumours, aneurysms, and the like. In these conditions the dose must be indefinite, but it is to be distinctly borne in mind that in giving large doses one is surely approaching the end of the usefulness of the drug.

It is of inestimable value where death is inevitable and imminent, to relieve pain and restlessness. The latter condition may be purely reflex, and the patient may be unconscious of it; but it may be so distressing to his family that one is justified in controlling it by a small dose of morphine, administered by preference subcutaneously.

As a means of inducing sleep in many conditions of delirium it is without a rival. To do this it is not necessary, nor is it proper, to narcotize the patient. It is largely the unjustifiable production of narcosis that formerly was in vogue that led to the disuse of this agent in all cases of *delirium tremens*. Sleep is recognised as essential to the cure of this condition, and if the pulse justifies its use chloral is certainly better; or if one can accomplish the purpose with any of the modern hypnotics it is certainly better not to use morphine. Moreover, if the delirium is very active it will not be controlled by a small dose of morphine; but occasionally cases of *chronic alcohol poisoning* occur, with great depravity of nutrition, anæmia, emaciation, and such feebleness of the heart's action as not to allow of the administration of chloral—cases with persistent, uncontrollable insomnia and mild delirium. Sometimes, after trying the safe hypnotics in vain, one is driven to administer morphine subcutaneously in this condition. A sixth, a quarter, a third of a grain will sometimes succeed when other agents have failed. In general, in delirium tremens it is not so good as other agents.

In raving *mania*, with active circulation, small doses will not produce sleep, and large doses are not well borne. But, combined with hyoscine hydrobromide and given subcutaneously, morphine is of great utility in this condition.

In the milder *delirium of nervous exhaustion in the acute fevers* small doses will often supplement in an admirable way the supporting and stimulating treatment that is most appropriate, as has been already stated.

In *melancholia* a few small doses are often most serviceable, as they also are in wakefulness and delirium from anæmia of the brain after severe hæmorrhages.

The same distinction must be drawn in regard to *dyspnœa*. In dyspnœa from respiratory disease opium narcosis would be likely to aggravate the condition, but that is no reason why a small dose should not be administered in *bronchitis*, or *pneumonia*, or *pleurisy* associated with wakefulness from incessant cough or from pain. Indeed, in these conditions such treatment is often highly beneficial.

Its use has been properly abandoned as unjustifiable in tetanus, epilepsy, and chorea. The same is true of hiccough and asthma.

In *obstinate vomiting* it is often of great value.

Bright's disease in general and *uræmic convulsions* in particular were formerly regarded as absolute contra-indications to the use of opium in any form. Although other agents are, without doubt, better in general, still it is true that small doses of morphine will often act as a useful adjunct in the treatment of uræmic convulsions. No other agent with which I am familiar is so useful in the dyspnœa which is associated with the uræmic condition.

In the treatment of *cough* it is in general not a desirable agent.

It is of great value, associated with rest, as a means of averting *abortion* if that accident is susceptible of being averted in any given case.

In some forms of *inflammation* it seems capable of opposing the morbid process in an unknown way. Many people can abort an

acute catarrhal attack by taking a small dose of opium and facilitating perspiration.

In *peritonitis* it is often proper to push it to the verge of the production of narcotism. A useful measure of the dose is given by the respirations, which, in this condition, may be reduced to the frequency of twelve a minute.

As a means of repressing intestinal secretion small doses are of great value in the treatment of *diarrhœa*, if that is not kept up by the presence of irritants in the intestine.

In *dysentery* it is used symptomatically to relieve the pain and tenesmus. To cure the disease the modern local treatment is of incomparably greater value.

[There are some persons who bear opium badly under ordinary circumstances; they are narcotized by comparatively small doses, or they suffer from cardiac weakness soon after taking the drug, or they experience in an exaggerated degree the unpleasant after-effects that are not uncommon. This is due, no doubt, to idiosyncrasy in the great majority of instances, but there seems reason to attribute it to *hysteria* in some cases. Nevertheless, morphine has been recommended for the cure of *hysterical anorexia*. M. Dubois (*Progr. méd.*, Feb. 22, 1896; *N. Y. Med. Jour.*, March 14, 1896) reports three cases in which he used it subcutaneously with success after all other treatment had failed. He says that, if the morphine is well tolerated, no inconvenience will arise from the employment of three injections a day, each containing ¼ a grain of morphine hydrochloride, at intervals of four hours. M. Dubois insists upon the following points: 1. The injections should be given each day at the same hour, and food should be given half an hour after the injections, with or without forced feeding. 2. The patient must be assured that the food will be retained and will cause no pain. If this treatment, both physical and psychical, he says, is well directed, in less than three months a rebellious anorexia may be cured. The strength of the solution is diminished from week to week until a final cessation of the use of the morphine is attained.]

A minute dose of atropine, a hundredth of a grain or less, seems often to add to the useful effects of a small dose of morphine and to diminish its unpleasant effects. It must not be forgotten that among the effects which it is likely to control is the sweating, and therefore atropine should not be given if this is desired.

Of the preparations of opium itself the best to use are the deodorized preparations of the pharmacopœia. Those made from the crude drug should be abandoned, as causing needless subsequent discomfort to the patient. With deodorized opium, the deodorized tincture, and the tincture of ipecac and opium, practically we have all the preparations that are necessary, if we except paregoric, which for the administration of minute doses is of distinct value. (See PAREGORIC.) Laudanum is especially objectionable and should never be used.

[In an article on the therapeutic abuse of opium (*Jour. of the Am. Med. Assoc.*, Jan. 25, 1896), Dr. G. Walter Barr, of Keokuk, Iowa, remarks that, while our knowledge of pathology and physiological action has long since passed the point of the treatment of symptoms, yet we still cling to this one drug which does most of its work in relieving symptoms only, but must always be a potent agent for therapeutic good. Chemically and physiologically, he continues, opium is perhaps the most complex drug in the pharmacopœia. It contains a large number of active principles which have been isolated, and a number more that are probably present in the crude drug, although it is maintained that they are merely products of chemical manipulation. It may also contain some that have not yet been identified as chemical entities by laboratory research. It seems a little strange, says Dr. Barr, that, with the present tendency to prescribe the use of the drugs uncombined with others, so many active principles should be so often prescribed at once under the title of opium. That the combination of so many principles has, by virtue of the correlation of physiological forces, a dynamic action of its own, is obvious; that this action, he says, can not be prognosticated with much certainty is proved by the large number of cases of alleged idiosyncrasy. That opium is of great therapeutic value is maintained at the outset; that it is overrated is also contended.

When the natural polypharmacy of opium itself is avoided, says the author, its most active constituent, morphine, is nearly always resorted to. The effects of morphine upon the secretions, upon metamorphosis, and upon the disposal of waste products are exactly what is not desired in most cases of disease. Yet morphine is usually chosen to produce certain effects upon the nervous system without regard to its energetic action in other directions. Dr. Barr regards codeine as for many purposes preferable to morphine. He is thoroughly satisfied that it does not produce bad habits, even in highly sensitive neurotics, and that it acts with little energy upon the digestive tract and the heart. As a *cardiac stimulant*, morphine, he says, acts quickly and energetically, but the after-depression which always comes after its use may be avoided by using strychnine, nitroglycerin, caffeine, digitalis, or even atropine, in the proper dose. To use opium or morphine for a condition of nervous excitation and exalted reflexes is, in many cases, says Dr. Barr, like stunning a refractory patient with a club. Valerian, hyoscyamus, and the bromides will, he thinks, generally give better therapeutic results of greater permanence, and with less risk.

It is in those diseases of the digestive tract which are commonest in summer, says Dr. Barr, that opium does the most harm. Close observation, he says, must drive the physician to the conclusion that very rarely indeed is opium indicated in the treatment of *diarrhœa*. This affection usually needs some drug which increases the excretory functions, and thus drives out of the body something which, by its presence, is producing the flux from the bowel. Opium temporarily relieves the chief symptom at once, and when its influence has subsided and the disease still persists the condition

is called a relapse or a new attack. Dr. Barr admits that opium has a real value therapeutically in certain *inflammations*, in *great pain*, in rare forms of *diarrhœa*, as a splint for the intestines, and in some other conditions.

The usual dose of opium, either in its crude form or in powder, *opii pulvis* (U. S. Ph.), for an adult is 1 grain, and the maximum under ordinary circumstances is 2 grains; not more than 7 grains should be given in the course of twenty-four hours. Young children are singularly susceptible to opium, and the dose, if the drug is to be used at all for infants should be minute. Dr. Samuel O. L. Potter (*Handb. of Mat. Med., Pharm., and Therap.*) reminds us that a single minim of laudanum has killed a child a day old, and that a medicinal dose given to a nursing mother has proved fatal to her infant. The dose of opium for a child a year old should not exceed $\frac{1}{30}$ of a grain, and even this should be given with caution. If opium is given to children less than a year old, some dilute preparation, such as paregoric, should be selected, and great caution observed that the dose directed is so small at first as to contain but an infinitesimal amount of opium; indeed, in the case of very young infants it is safer not to use opium. The aged, too, are very susceptible to opium, and with them the ordinary doses should be materially reduced. Besides these considerations of age, idiosyncrasy should not be forgotten; there are some persons in whom even a small dose of opium or morphine produces alarming depression, and so it is apt to do in the case of hysterical women. Hence, in prescribing opium for a given individual for the first time, it is prudent to order only very small doses, and, as a general rule, somewhat smaller doses should be prescribed for women than for men. The doses of opium and those of its United States, British, and German official preparations that are given internally are as follows:

	For an adult.	For a child a year old.
Acetum opii (U. S. Ph.)	10 to 15 drops.	$\frac{1}{2}$ to $\frac{3}{4}$ drop.
Confectio opii (Br. Ph.)	5 " 20 grains.	$\frac{1}{6}$ " $\frac{1}{3}$ grain.
Extractum opii (U. S. Ph., Br. Ph.)	$\frac{1}{4}$ grain.	$\frac{1}{30}$ "
" " (Ger. Ph.)	1 "	$\frac{1}{10}$ "
" " *liquidum* (Br. Ph.)	10 " 40 minims.	$\frac{1}{2}$ " 1½ minim.
Opii pulvis (U. S. Ph.) / *Opium* (U. S. Ph., Br. Ph., Ger. Ph.) / *Opium deodoratum* (U. S. Ph.)	1 grain.	$\frac{1}{30}$ grain.
Pilulæ opii (U. S. Ph.)	1 pill.	Not to be used.
Pulvis ipecacuanhæ et opii (U. S. Ph.) / " " *opiatus* (Ger. Ph.) / " *opii compositus* (Br. Ph.), which is *not* Dover's powder	or Dover's powder 10 grains.	$\frac{1}{4}$ grain.
Tinctura opii (U. S. Ph., Br. Ph.)	2 " 5 "	$\frac{1}{12}$ to $\frac{1}{6}$ "
" " *ammoniata* (Br. Ph.)	5 " 40 minims.	$\frac{1}{6}$ " 1 minim.
" " *benzoica* (Ger. Ph.)	½ " 1 fl. dr.	1 " 2 minims.
" " *camphorata* (U. S. Ph.)	200 minims.	6 "
" " *crocata* (Ger. Ph.)	1 " 4 fl. dr.	2 " 8 "
" " *deodorati* (U. S. Ph.)	20 minims.	½ minim.
" " *simplex* (Ger. Ph.)	5 " 4 "	½ " 1 "
" *ipecacuanhæ et opii* (U. S. Ph.)	12 "	¾ "
Trochisci glycyrrhizæ et opii (U. S. Ph.) / " *opii* (Br. Ph.)	10 " 1 lozenge.	¾ " Not to be used.
Vinum opii (U. S. Ph., Br. Ph.)	10 minims.	¼ minim.

The *enema opii* of the Br. Ph. consists of ½ a fl. drachm of laudanum and 2 fl. oz. of mucilage of starch, the whole to be administered at once by injection into the rectum. The official opium plaster, *emplastrum opii* (U. S. Ph., Br. Ph.), is occasionally employed as an anodyne plaster. Care should be taken that it be not applied over a part denuded of epidermis. The same is to be said of opium liniment, *linimentum opii* (Br. Ph.). For the *unguentum gallæ cum opio* (Br. Ph.), see under GALLS. Sydenham's laudanum, *vinum opii compositum* (Fr. Cod.), is practically the same as *vinum opii*. For lead-and-opium wash, see under LEAD, p. 577.

Morphine, *morphina* (U. S. Ph.), and its salts—the acetate, *morphinæ acetas* (U. S. Ph., Br. Ph.), the hydrochloride, *morphinæ hydrochloras* (U. S. Ph., Br. Ph.), *morphinum hydrochloricum* (Ger. Ph.), and the sulphate, *morphinæ sulphas* (U. S. Ph., Br. Ph.)—are practically of the same strength. The proper initial dose is from $\frac{1}{8}$ to $\frac{1}{6}$ of a grain.

A fl. drachm of *injectio morphinæ hypodermica* (Br. Ph.) contains 4½ grains of acetate of morphine (formed from the hydrochloride by the action of the acetic acid used in its preparation). The dose, by subcutaneous injection, is from 1 to 5 minims. The dose of *liquor morphinæ acetatis* (Br. Ph.), by the mouth, is from 10 to 60 minims.

The dose of *liquor morphinæ hydrochloratis* (Br. Ph.), by the mouth, is from 10 to 60 minims. The *trochisci morphinæ* (Br. Ph.) contain each $\frac{1}{16}$ of a grain of the hydrochloride. From 1 to 6 lozenges may be given at a dose. The *trochisci morphinæ et ipecacuanhæ* of the U. S. Ph. contain the sulphate; those of the Br. Ph., the hydrochloride. From 1 to 6 may be given at a dose. The *suppositoria morphinæ* of the Br. Ph. contain each ¼ a grain of the hydrochloride. The *suppositoria morphinæ cum sapone* (Br. Ph.) contain the same amount of the morphine salt along with glycerine of starch, powdered starch, and curd soap.

The dose of *pulvis morphinæ compositus* (U. S. Ph.), containing the sulphate, is from 7 to 10 grains. A solution of sulphate of morphine containing 16 grains to the fl. oz., commonly known as Magendie's solution of morphine, was formerly official, and is still much used. The dose, by subcutaneous injection, is from 3 to 7 minims.

Another salt of morphine, the bimeconate, figures in the *liquor morphinæ bimeconatis* of the Br. Ph., the dose of which, by the mouth, is from 5 to 40 minims.

The dose of codeine, *codeina* (U. S. Ph., Br. Ph.), is from ¼ to 1½ grain; that of the phosphate, *codeinum phosphoricum* (Ger. Ph.), is the same. Not more than 7 grains of codeine should be given in the course of twenty-four hours (cf. CODEINE).]

Toxicology.—In its toxicological relations opium is of great practical importance, because it is one of the commonest of all the poisons and is everywhere easily accessible. Moreover, its poisonous properties are well known to the laity. Thus, either under its own form or in the form of a morphine salt, it is a frequent cause of death, both by murder and by suicide.

It is said by Taylor to have been the cause of five hundred and forty deaths in England in five years.

The fatal dose of opium can hardly be definitely stated—*i. e.*, the smallest fatal dose. Even large doses produce very uncertain effects under different circumstances. Thus, a large dose may be promptly vomited and may in this way fail to be absorbed; or following the ingestion of a large dose and the absorption of a certain amount of it, one effect of the drug then may be to retard the absorption of the rest, and in this way the total effect of the large dose may be less than would have been expected.

Individual susceptibility to the poisonous effects of opium differs, as is the case also with regard to its therapeutic effects. Thus, two persons of similar weight and health may be poisoned to very different extents by the same dose; and, again, of two persons who may seem to present the same degree of poisoning, the same depth of coma, etc., one will die and the other get well under exactly similar conditions as to treatment.

This latter observation is equally true in disease; it is often impossible to say why one man dies and another does not in conditions of acute disease.

Besides these causes of uncertainty as to a minimum fatal dose, treatment becomes a disturbing element in determining this point, for it may in any given case modify the natural course of the symptoms and prevent a fatal issue.

Probably the smallest fatal dose of which we have satisfactory knowledge is 2½ grains of the extract, which may be said to be the equivalent of 4 or 5 grains of opium. One, 2, and 3, drachms of laudanum have killed, and ½ an ounce of the latter preparation has often proved fatal.

It is stated, even in recent editions of good text-books, that cases have occurred in which the subcutaneous administration of so small an amount as $\frac{1}{6}$ of a grain of a morphine salt has caused death. These cases are alluded to briefly, in edition after edition, quoted by author after author, without any one apparently giving himself the trouble to trace them to their origin and ascertain whether they are well observed and well recorded, and especially whether all possibility of other contributing factors has been excluded in assigning the causes of death.

It is probably true that ¼ a grain of a morphine salt has caused death; it is probably untrue that any smaller quantity has done so.

On the other hand, recovery has occurred, without vomiting, after the ingestion of 55 grains of opium, and after 6 ounces of laudanum, which contained 225 grains.

In two cases recovery is known to have occurred from 8 ounces of laudanum, although the patients were untreated for hours.

Infants are easily poisoned, and indeed a large percentage of opium deaths is contributed by children under five years of age. One explanation offered of this fact is that in childhood the brain is proportionately larger than in adult life and that, as opium probably acts only upon the central nervous system, it thus can operate more powerfully upon children.

It is stated on excellent authority that the death of a child four years of age was caused by a single grain of Dover's powder. It is perhaps not unlikely that this preparation may be sometimes carelessly compounded, so that the ingredients are unevenly mixed and the opium percentage in a given specimen may thus be higher than we suppose. It would perhaps be safer not to give this preparation to children at all.

Of the numerous children whose deaths have been traced to minute quantities of opium, it can be said that we have no testimony as to the excellence of the preparation which was used, and often none as to the diseased condition of the patient which caused the administration of the drug. In a child nine months old four drops of laudanum are said to have caused death.

Infants a few days old are said to have been killed by two drops and even by a single drop of laudanum; but in this latter case we are informed that the bottle had been left uncorked, and its contents had presumably become concentrated by evaporation.

The nearest approach to a vanishing quantity as the cause of death with which I am familiar is found in a case recorded by Taylor, that of an infant four weeks of age who is said to have been killed by 2½ minims of paregoric which ought to have contained only about $\frac{1}{90}$ of a grain of opium.

It is well to bear in mind that under treatment children have often recovered from large doses. Thus a child nine months of age recovered after swallowing 2 drachms of laudanum, a quantity that has often killed an adult.

It is probably safe to say that, if a healthy adult who is not accustomed to opium should take 4 grains of opium or a grain of a morphine salt, he should be carefully watched, and if necessary carefully treated, as having taken a quantity which is on the border line of possibly fatal dosing.

Symptoms of Poisoning. — Overpowering drowsiness is one of the early symptoms. It is often possible before the poisoning has

become very profound to bring about an instantaneous change from deep sleep to full wakefulness by arousing the patient rather forcibly, but, left to himself again, he relapses into his former condition.

Contraction of the pupils is seen in the drowsy stage. If the patient is kept awake by external irritation, he is likely to become conscious of dryness of the throat and thirst. There is a distinct disposition to perspire. The pulse, which is accelerated by a small dose of opium and also during the earlier symptoms following a large dose, becomes rather slow and full as symptoms of poisoning deepen.

Respiration becomes steadily diminished in frequency as the poison proceeds.

Before consciousness is lost, complaint is often made of a sense of fulness of the head, beginning at the nape of the neck.

In some cases there is an early development of mental excitement, with more or less confusion of ideas, and at the same time a sense of general heat which may be almost insupportable may precede the sweating.

During this initial stage nausea and even vomiting may occur.

The sleep soon deepens into a semi-coma or deep stupor from which the patient can still be aroused, but with difficulty, and if he is aroused he very speedily becomes again unconscious on being left to himself.

The face is often congested, the skin generally more or less anæsthetic, and itching at the nose becomes in some cases a very prominent symptom.

All these symptoms may pass off without treatment if the dose has not been very large. In case the dose was actually a poisonous one, and especially if the stomach was empty and the preparation a soluble one, this condition may come on rapidly, and there may be an intensification of many of the symptoms. There is profound stupor, with complete muscular relaxation and absolute anæsthesia. All the nerve-centres seem to be overwhelmed—the medulla oblongata alone continuing to perform its function sufficiently for the maintenance of life, but in a very imperfect manner.

An evidence of centric impairment is seen in the facts that emetics are of no avail and that mustard fails to redden the skin.

After the stupor has lasted for a few hours with these symptoms, if the patient is not treated, or if treatment is unsuccessful, respiration becomes slower and shallower, and the heart's action, which was full and slow, becomes rapid and feeble. As this change takes place the venous congestion of the face, which was caused by impairment of respiration without much impairment of heart power, gives place to a ghastly pallor; the skin, which was previously warm, becomes cold and the sweating continues.

The pupils have become tightly and uniformly contracted and not responsive.

Death is caused by apnœa, commonly in from six to twelve hours after taking the fatal dose. Convulsions may precede death, and may be said to be not uncommon in children.

If the poisoning is not fatal, recovery takes place gradually and is attended by great prostration, languor, listlessness, disordered digestion, and very often nausea and vomiting, anorexia, constipation, relaxed skin, headache, and sometimes dysuria.

Such may be said to be about the usual clinical picture from toxic doses of opium and morphine, but it must be admitted that cases occur in which the effect of idiosyncrasy or of habit will be seen to modify greatly the course of the symptoms.

Of the symptoms of poisoning, certain ones may be said to be *alarming* and to indicate the necessity for immediate and active treatment. One of them is coma so deep that the patient can not be aroused, accompanied or not by stertorous breathing. The face may be pale and ghastly if the pulse has become feeble, instead of being suffused and livid, as it probably was at an earlier period in the same case. This pallor is an indication that the heart power is failing, and is a direct suggestion of the need of treatment to be addressed to that organ. At the same time the pulse will be rapid and feeble, instead of slow and full, as it is early in the onset of symptoms of poisoning.

Another alarming symptom is great decrease in the number of respirations (below ten to the minute), and the respiratory act is likely to be accompanied by tracheal râles. There are apt to be noted dropping of the lower jaw as an indication of muscular relaxation, complete relaxation of the sphincter ani, and almost always, preceding death, dilatation of the previously contracted pupils.

The diagnosis of opium poisoning would thus seem to be easy; but excellent authorities believe it to be impossible without a history of the taking of the drug. In other words, they believe that the diagnosis may be impossible if one has the symptoms only to guide him.

Cases certainly bear much resemblance to some cases of uræmia and to some cases of alcohol poisoning, and still more to apoplexy. Indeed, hæmorrhage into the pons Varolii produces all the symptoms of opium poisoning, including extreme and it may be equal contraction of the pupils. In all these conditions there may be coma, stertorous breathing, slow respiration and pulse, and a congested face. In opium poisoning we see contracted pupils, in alcohol poisoning dilated pupils, in apoplexy often unequal pupils, except in hæmorrhage into the pons. Moreover, inequality of the pupils is said to have occurred in opium poisoning, and, if atropine has been previously applied locally—as it may well be in criminal cases with intent to deceive—the resulting mixture of symptoms may be extremely confusing.

Unilateral paralysis with an hypertrophied heart or with valvular disease would point to brain lesion as the cause of the coma.

The history of the case is of course the chief aid to diagnosis.

The presence of albumin and casts in the urine would point to uræmia, but would not necessarily exclude opium; moreover, it must

be borne in mind that there is ample clinical evidence that the urine may promptly become highly albuminous in ordinary apoplexy or even in cases of traumatic intracranial hæmorrhage, although the kidneys may have been previously healthy.

The smell of alcohol in the breath or of the various ethers that occur in spirits may be misleading, for the patient may have taken both these poisons in overdoses. The smell of opium might be a help, but there is no odour to morphine.

The detection of morphine in the urine might help greatly, but in ordinary cases it is not practicable to resort to this aid to diagnosis.

Erection of the penis is an unusual symptom, but when it occurs in coma it points to opium poisoning.

The time of the onset of cerebral symptoms varies considerably even in fatal cases, and this has an important bearing on jurisprudence. The patient may be able to perform intelligent acts two or three hours after swallowing a fatal dose, but generally symptoms begin in from half an hour to an hour. The length of time that elapses before the development of symptoms depends upon the rapidity with which the toxic dose has been absorbed, and this is dependent upon the form in which it is taken, whether fluid or solid, and upon the condition of the stomach as to its being empty or not when the poison is taken.

Even after hours of absolute stupor the patient may sometimes be aroused and become rational, and ultimately relapse into coma and die in spite of energetic treatment.

A case is recorded in which an ounce and a half of laudanum was taken. After more than nine hours of coma the patient rallied, his face became natural, his pulse grew steady, his power of swallowing returned, he recognised the bystanders, and in a thick voice gave an account of the accident. This state lasted several minutes. He then relapsed into profound coma and died after the lapse of about five hours.

I have been roundly abused by a patient whose life I was trying to save by the usual means of treatment because they were disturbing to him, and he preferred to be left to himself in his enjoyment of the effects of the poison; and, in spite of my persistence with ample assistance to relieve me, I have seen him relapse into a condition of coma and die from gradual failure of heart power, although we kept him breathing regularly. Although death generally occurs in from six to twelve hours, in rare cases it has taken place in five, three, two hours, and in one case in three quarters of an hour. In this latter instance a soldier had swallowed an ounce of laudanum and died in convulsions.

On the other hand, death is sometimes postponed, usually by the effects of treatment, from fifteen to twenty-four hours. Generally, it may be said that if patients survive twelve hours and recover from the stupor they ultimately get well, but this is not always the case. In case of recovery it may be several days before all the symptoms have disappeared.

From what has been said it may be inferred that the prognosis in any given case is exceedingly difficult to make with certainty, and it may often be impossible; and from this the logical inference is that, no matter how grave the symptoms are, treatment should never be suspended until the heart has ceased to beat.

Treatment.—If the patient is seen early enough to justify the hope that some of the poison may still be in the stomach, that viscus should be emptied. If the symptoms are not already very pronounced it is safe enough to administer an emetic. For this purpose mustard followed by copious draughts of warm water is perhaps the best. Apomorphine may be given subcutaneously if the coma is not profound; but if it is, the inference is justified that the vomiting centre is not likely to respond to any emetic, and, furthermore, when it has failed to act under these circumstances, apomorphine has seemed to aggravate an existing condition of collapse. The irritant emetics should not be administered if there seems any likelihood that they may not operate, unless there is the means at hand of removing them from the stomach in case of their failure to act. This means is the stomach-pump or gastric siphon; and, if this is at hand, it is far better to use it at once than it is to depend upon any emetic. On the whole, it is better, in cases in which one may be in doubt as to the existence of the poison in the stomach, to give the patient the benefit of that doubt and wash out his stomach. It is well, if possible, to have the washings tested until they no longer respond to tests for morphine before feeling that this procedure may be discontinued. But it should be borne in mind that solid opium may remain in the stomach in spite of the most energetic and persistent lavage.

It has been maintained of late that symptoms of poisoning may be aggravated by the reabsorption of morphine which has been once excreted by the gastric mucous membrane, and that therefore one single emptying of the stomach may not be sufficient in a given case. On that account, perhaps, it is well to lay stress upon the fact that has already been mentioned of the desirability of continuing the process of lavage as long as the stomach-washings respond to the chemical tests for morphine.

This proceeding must not be undertaken if the respiration is clearly failing; then the most imperative duty is to attend to that function, and neglect everything else that might interfere with it. It is plain that the most important thing to do is to keep the patient breathing. As an aid to this end it is important, if possible, to keep him awake. If he becomes comatose he ceases absolutely to render voluntary assistance in the matter of respiration, but if he is kept awake he not only breathes because he feels the instinctive necessity which impels him in health, but he can also be made to inspire deeply at command.

Of the numerous chemical antidotes, none is available after the poison has been absorbed,

and, unless it has been impossible to empty the stomach, none can be said to be indicated.

Tannin is perhaps the best of them, and it may be administered in the form of a vegetable infusion, as in the shape of a cup of strong tea. It forms a compound with the morphine which is temporarily insoluble, although it would be likely to undergo slow solution and absorption if it were allowed to remain in the alimentary canal.

Coffee tends to diminish somewhat the benumbing effects of opium, and is useful as a means of preventing the onset of coma and of lessening the severity and the duration of coma which may already have come about. Coffee may be administered by the stomach or by the rectum, or by both.

If it is possible to cause the patient to walk about between two attendants, this may act as an external irritant to the extent of preventing the supervention of coma. A similar service is sometimes rendered by any efficient and equally harmless external irritation. Shaking the patient, beating him gently with a towel or with a slipper or a bundle of twigs is often resorted to. These proceedings all have the object of keeping the patient awake, which has already been shown to be important in itself.

As a stimulant to respiration, cold affusions to the chest or the nape of the neck are of decided value. It is important to avoid chilling the patient's surface too severely, and on this account it is preferable to use alternate hot and cold affusions.

These and all other means that are used must be intelligently employed. Care must be taken not to exhaust the patient by too energetic treatment, and therefore the frequency and force of the pulse must be closely watched and any indications for treatment by stimulants carefully observed.

The great importance of keeping up the respiration has been alluded to, and certain means to that end have been mentioned. In case the coma is pronounced and the respiration failing, artificial help to accomplish this purpose must be resorted to. The application of the faradaic current to the region of the phrenic nerves in the neck, or the application of an electrode over the ensiform cartilage and the other over the phrenics, seems occasionally to cause contraction of the diaphragm, although, upon the whole, this is likely to be a disappointing procedure. The current need not be strong, and certainly no stronger than the operator can himself bear without pain.

Artificial respiration is a more troublesome but a much more efficient means of accomplishing this end, and it should be performed with every precaution to insure the potency of the air-passages, such as drawing the tongue forward, etc. It should not be too frequently repeated, eighteen times a minute being about as often as is desirable. The use of atropine in opium poisoning depends largely upon its effect upon the respiratory centre. The subject of this use of atropine is so important and so generally misunderstood that it is proper to lay stress upon it. It is largely used as the physiological antagonist to opium in spite of the fact that it is not, properly speaking, such an agent. Indeed there is much difference of opinion as to its possessing any efficacy at all in opium poisoning, although the weight of opinion is strongly in favour of its usefulness within certain limits.

Atropine is not in any proper sense a physiological opponent of opium—*i. e.*, the two drugs are not possessed of the power of causing exactly opposite effects, nor are their effects mutually abrogated by the employment of suitable doses. Atropine in part opposes and in part enhances the action of opium, as it does with regard to certain other drugs whose actions are complex. Thus, in relation to calabar bean, atropine opposes the action of calabar upon the pupil, upon the spinal cord, and upon the respiratory centre, but it enhances the effect of the other poison upon the motor nerves and upon peristaltic activity.

Equally mixed are the relations between atropine and morphine. They are synergic in many of their effects, as in their production of motor-nerve palsy, sensory anæsthesia, spinal irritation, and cerebral disturbance. Even with regard to those organs which they affect very differently in small doses—namely, the heart and lungs—even here in large doses they become synergic, and poisoning by one of them may be aggravated in regard to the heart and the respiration by adding the *poisonous* effects of the other.

It is important, therefore, to lose sight of the oft-quoted idea of one of these drugs being an opponent to the other. This idea leads to the false conclusion that the effects of a large dose of one of them may be neutralized by a properly adjusted large dose of the other. Practice founded upon this theory would be likely to kill patients by the combined effects of the two poisons.

The real question to be answered is this: Is atropine useful in opium poisoning? It certainly is of great value, exactly as drugs are of value in treating disease. The effects of opium poisoning are to be regarded as a disease from which the patient is suffering. As is the case with many other acute diseases, it may be curable if it is not too severe, or it may be so severe as to prove fatal in spite of intelligent treatment. But for the intelligent treatment of the condition it is important to get rid of the idea that we have an agent which will act as a chemical or even as a physiological antidote to opium after it has been absorbed and has reached the nerve-centres.

Atropine is both a medicine and a poison, as opium is. Certain of its medicinal powers happen to have a curative influence over some of the more formidable symptoms of the opium disease. Hence, properly used in that condition, it may do much good, and may even be the principal means of saving life; but it may fail in too severe a case to influence these symptoms to the patient's benefit. Its poisonous effects are of a kind parallel with the worst symptoms of opium poisoning, and hence are especially to be avoided in that condition.

How, then, is it that atropine does good? It

is often answered that it will dilate the pupils which have been contracted by opium; but that symptom of opium poisoning does not kill, and it matters little to a man whether he dies with a small pupil or a big one. Moreover, the effect of atropine upon the pupil is of no use as a guide, even in the matter of dose. Opium contracts the pupil by a centric influence; atropine, while not opposing this centric influence in the least, dilates the pupil by its power over the periphery.

The valuable and indeed the essential point is that atropine directly irritates the respiratory centre, which has been more or less completely paralyzed by opium, and thus averts asphyxia; it sometimes actually restores the frequency and depth of the respirations. Besides this, it enables the heart to overcome the difficulties which the opium has imposed upon it; it accelerates the pulse and increases the arterial tension, and thus relieves the condition of congestion of important organs which opium has brought about.

As to doses of atropine much difference of opinion exists. In opium poisoning there is a greatly increased tolerance of belladonna. Doses of the plant or its alkaloid which would be likely to be fatal under ordinary circumstances have been freely and safely given. Under conditions of profound physiological disturbance there is in general an unusual tolerance established of many powerful drugs. Thus, opium is borne in enormous doses in tetanus and after profuse hæmorrhage. It is best to administer atropine subcutaneously. It is almost impossible to define the doses sharply, but in general we must expect to give large quantities. We are guided in this respect by the physiological effect, and to this end we must watch especially the clinical results upon the respiration and pulse. If the respirations rise to a frequency of ten a minute, probably no further administration of atropine is necessary. If the pulse increases in frequency and diminishes in force under its influence, too much has been given. The state of the pupils, as we have seen, is absolutely valueless as a clinical guide, having no relation whatever to the antagonism between the two poisons which is really of value.

No direct effect upon the condition of coma is to be expected—unless, indeed, the atropine is given in poisonous doses, when it will deepen the coma due to morphine.

It is a matter requiring great nicety of judgment to determine when to give atropine and how much to give. It is perhaps as good a plan as any to give it in every case in which the respirations are failing, and to continue to give it in small doses until distinct improvement in this function has taken place. From a twenty-fifth to a fortieth of a grain may be given, to begin with, subcutaneously; and every twenty minutes the smaller of these doses may be repeated until three or four doses have been given, unless earlier improvement in the patient's condition renders such repetition unnecessary. If the condition of respiration is improving, give no more atropine while the improvement lasts. It must never be forgotten that it is possible by overdosing to add the coma of atropine to the coma of morphine.

Very large doses of atropine have been given without injury to the patient. In bad cases a grain has been given at a dose, or a half grain, repeated in an hour. Doses of a quarter and a third of a grain have often been given. It is far better to give smaller doses and repeat them at short intervals.

It is important to emphasize the fact that cases which were apparently desperate have ended in recovery under active and intelligent treatment. I have several times seen patients recover whose respirations were as infrequent as four in the minute.

Within the last few years much has been written of potassium permanganate as an antidote to morphine; and there is reason to believe that, if the two agents are placed in the stomach together, the former may oxidize the latter and alter it chemically so as to interfere with its action. But there seems at present no good reason to believe that the permanganates can affect the course of the poisoning after the morphine has been absorbed into the circulation.

Chronic Opium Poisoning.—Chronic poisoning, or "opium eating," is a very common vice in the East, and is probably becoming of more frequent occurrence here. In China it has long been a national evil and has more than once necessitated legislation, and led to foreign warfare, without, however, any real tendency toward its suppression. Thus, in a town of a million and a quarter inhabitants nearly eight thousand pounds of opium are consumed a month. Formerly it was taken either by the stomach or by inhalation, as in smoking, but of late years the worst victims of this drug that we see here are those who have learned to take it subcutaneously.

In the East there is open and deliberate indulgence in opium as a matter of luxury, just as there is in regard to whisky and tobacco with us. Mohammedans use opium largely because the Koran forbids the use of alcohol. With us and in Europe a large majority of the victims of this habit have acquired it as the result of having to use the drug for medicinal purposes—or, in other words, they owe their misfortune directly or indirectly to some doctor. Deliberate indulgence in opium and deliberate formation of the habit of indulgence in it are comparatively rare with us, although perhaps less rare than they were a generation ago, before we had learned opium smoking from our Chinese immigrants.

These facts should make us extremely cautious in recommending or administering morphine, especially subcutaneously.

It should never be forgotten that, if it is once acquired, the habit of taking morphine subcutaneously is harder to break than any other of the opium habits. Like all habits which depend upon self-indulgence, it most easily fastens itself upon people of weak and vacillating character, especially upon sufferers from insomnia or from chronic pain. These reasons should prevent our using this drug in

the treatment of chronic disease if it is possible to avoid it.

In general, the effect of chronic opium taking may be said to be an interference with digestion, followed by malnutrition, anæmia, emaciation, and later failure or perversion of power—physical, mental, moral—and, if the habit is continued and increasing doses are taken, as is usually the case, comparatively early death.

In aggravated cases the patients are emaciated and shrivelled, with a sub-icteric hue, and are apt to suffer from a variety of nervous symptoms. They are feeble in mind and character as in body. They complain of vertigo, headache, insomnia, and neuralgia; they are fanciful and discontented, peevish and irritable. They manifest failure of memory, intelligence, energy, and will; and they are especially prone to be untruthful about their opium indulgence.

Taking it by the stomach is especially likely to disorder digestion, while those who take it by injection or by smoking are likely to be able to do so without as much impairment of appetite or digestion.

Those who indulge in opium commonly take but little interest in the parallel vices, namely, those of alcohol and tobacco; but exceptionally an opium eater of more than common energy is found who unites the three forms of indulgence. Of late, too, a combination between opium and cocaine has been repeatedly made and with the most disastrous results. Combinations between opium and the other hypnotics are becoming very common.

In spite of the gravity of this vice in its ultimate effects, which I have endeavoured not to exaggerate, it is only fair to admit that a persistent moderate indulgence in opium or morphine by people of regular habits and good general surroundings has often been shown to be possible without impairment of health. As has been said elsewhere, in the East millions of thrifty, well-to-do people use opium daily as the European does his wine, and with no more thought of excess. Such moderation in opium indulgence seems hardly possible with us, or, at all events, it may be said to be unusual.

Opium seems to have the same tendency to repress secretion when taken chronically as when taken occasionally. Chronic opium-eaters show this in the diminished functional activity of the sebaceous and mammary glands, as also of the ovary, testicles, and intestines. Men are usually rendered impotent, and women are apt to cease to ovulate during the continuance of the habit. These functions are restored if the patients are cured.

The amounts which different people consume vary very greatly. It is not infrequent to find the daily allowance as low as two grains or as high as sixty.

Among those who use morphine subcutaneously, occasionally an intermittent fever develops whose paroxysms are less regular than those of malarial fever. It may, however, in any given case, easily lead to a false conclusion. The absence of malarial organisms and the impotence of quinine in checking it serve, however, to establish the diagnosis. As in true malarial fever, neuralgia is a common symptom also of this form of intermittent.

The prognosis of the opium-habit is very unfavourable as regards permanent cure; and it is extremely difficult to treat the individual attacks, if one may so call them. In general, it may be said to be more difficult to treat in proportion to its duration as a habit. Moreover, if the patient suffers from any chronic painful condition he seems to be really dependent upon the drug. Again, if he is of weak will-power and prone to yield to a desire for stimulants, or if he is in general self-indulgent, it may be impossible to treat him with success.

Treatment may be said to be possible in three ways. Either the drug may be withheld at once absolutely, or it may be withdrawn rapidly, or it may be gradually withdrawn. The exact method to be followed must be determined for each case, and it must depend upon the patient's general condition, the size of the doses, the number of doses that he takes in a day, and the original cause of the habit.

If he is in the habit of taking a few grains of morphine a day, not more than six or eight days should be consumed in withdrawing the drug completely. If he is habituated to large amounts—20 or 30 grains a day—probably twelve or fourteen days should be occupied in withdrawing the drug.

The very slow withdrawal—spoken of as "the tapering-off" process—is not a good one, and is not likely to be as well borne as the quicker method, or, as it has been called, the "rapid withdrawal."

The sudden withdrawal of the drug—and by this I mean the immediate and forcible cessation of the habit—is not a safe means of treatment in many cases. Active maniacal delirium may be caused by such a method, and very serious, threatening, even fatal prostration may ensue. Doubtless with some few patients whose general nutrition is not much impaired, whose habit is not inveterate, and whose daily allowance is small, this method may be the best one to follow.

Gastric disturbance, manifesting itself by anorexia or nausea or vomiting, may occur under any system of withdrawal; and so also may a rather profuse and watery diarrhœa.

The more frequent the antecedent relapses, the more difficult is the cure.

Patients who have tried all three methods are said uniformly to prefer the method by rapid withdrawal as being productive of the least pain and distress to them.

They are all apt to be untruthful as to the daily amounts to which they are accustomed, both to excite surprise in their attendants and to enable them to secure large doses in the course of their treatment. Before putting themselves under treatment they are apt to prime themselves with large doses. However intelligent and apparently in earnest they are, they are apt to conceal a supply about them and deliberately deceive the doctor while they appear to be improving. Before seriously be-

ginning treatment a patient must be removed from his usual surroundings and contact with his friends, for even these may also be party to the deceits that are so often practised. The patient's clothing should be searched if any suspicion arises as to his honesty of purpose. He should be surrounded by good, trusty, incorruptible attendants who should not be directly in his pay. Dangerous weakness, amounting even to collapse, may ensue, so that treatment may have to be suspended.

The general treatment should be supporting, and stimulating if necessary.

I have known the use of antipyrine internally to serve a useful purpose in calming a patient during the withdrawal of morphine. Its taste is suggestive of that of morphine, and in some cases may lead to the belief that morphine is being received.

In general, they are weaned from morphine in two weeks, but during this time they may suffer from insomnia, neuralgia, nausea, vomiting, diarrhœa, and other symptoms of general systemic derangement. The diarrhœa usually requires no treatment; the other conditions are to be treated upon general principles.

It is a good plan to give up the *night* dose last of all. Great assistance is derived from the modern hypnotics, such as sulphonal, trional, amylene hydrate, and others.

Of all the drugs upon which reliance is placed as a means of making the treatment less distressing to the patient, cocaine is perhaps the least desirable to use. It is extremely easy to engender a fondness for this alkaloid in these patients, and the combined cocaine and morphine habits are incomparably worse than the morphine habit alone.

The market is flooded with so-called opium antidotes. Most of them are solutions of morphine in disguise. The patient is easily deceived by them, because, while apparently abstaining from his drug, he feels pretty well, and does not miss it. All this time he may be taking more than he has been accustomed to take.

Of twenty "opium-habit cures," including all the principal "cures" advertised throughout the country examined in 1885–'86 by the State Analyst of Massachusetts, all but one contained morphine. This one was called a "double chloride of gold," and, while it did not contain morphine, it did not contain even the minutest trace of gold, and would have been quite as worthless if it had.

One plan of treatment which has been recently advocated can hardly be taken seriously. It is that by which codeine is substituted for morphine; and it is about as reasonable as it would be to attempt to cure a man of a fondness for whisky by giving him brandy in place of it. (See also PAREGORIC and under HYPNOTICS.)—GEORGE L. PEABODY.

OPODELDOC. — This is a camphorated soap liniment, *linimentum saponato-camphoratum* (see under SOAP).

ORANGES.—See AURANTIUM.

ORCHITIC EXTRACT.—See ANIMAL EXTRACTS AND JUICES.

OREXINE HYDROCHLORIDE, *phenyldihydrochinazoline hydrochloride,*

$$C_6H_4\begin{cases} NCH \\ CH_2NC_6H_5HCl. \end{cases}$$

is a complex derivative of quinoline that was introduced as a proprietary remedy in 1890. It occurs in colourless, odourless, lustrous crystals that have a bitter, pungent taste.

Originally Penzoldt recommended the substance as an active *stomachic* that increased the appetite and exercised a tonic influence on the digestive organs; but subsequent investigation showed that it neither promoted nor retarded digestion, and that it exercised no influence over the peptonization of albumin.

It was recommended for *anorexia* associated with anæmia, chronic gastric catarrh, neurasthenia, tuberculosis, and some neuroses. A number of physicians have reported that its administration produced eupepsia, while others, including the writer, have not observed any benefit following its use. In doses exceeding 6 grains it has caused nausea, vomiting, colic, and vertigo. The dose is from 1 to 3 grains, in a wafer, several hours before each meal.

SAMUEL T. ARMSTRONG.

ORGANIC EXTRACTS, ORGANOTHERAPY.—See ANIMAL EXTRACTS AND JUICES.

ORIGANUM.—*Origanum vulgare*, the wild marjoram, was formerly official, and was esteemed as a diaphoretic and emmenagogue. It has now fallen into almost complete disuse.

ORPHOL.—This is the copyrighted name of a compound said to contain 26·5 per cent. of β-naphthol and 73·5 per cent. of bismuth. Dr. E. Chaumier, of Tours (*Therap. Woch.*, Dec. 1, 1895), describes it as an efficient substitute for β-naphthol as an *internal antiseptic* and as being free from the offensive odour and burning taste of β-naphthol. He states that he has used it chiefly in the *diarrhœal diseases of children*, and has found it more satisfactory than other remedies of its class. Chaumier alleges that it is absolutely harmless and may be given to an infant a month old to the amount of from 30 to 45 grains in the course of twenty-four hours, and to older children to the amount of from 45 to 75 grains. The powder may be given in milk, syrup, or honey.

ORRIS ROOT, *rhizoma iridis* (Ger. Ph.), is the rhizome of *Iris germanica*, *Iris pallida*, and *Iris florentina*. The last-named plant, which is the commonest source, grows in southern Europe, particularly in Italy, whence by far the largest amounts are exported. The root as found in pharmacy is denuded of its epidermis and is rough, knotted, and irregular. Its odour is faint, peculiar, and agreeable; its taste is bitter and slightly acrid. It contains gum, extractive, resin, fixed oil, volatile oil, and vegetable fibre.

In large doses orris root is a gastro-intestinal irritant and competent to cause vomiting and purgation. In fact, it was at one time considerably used as a *cathartic* and an *emetic*. It is also said to be possessed of a considerable *diuretic* power. At the present time it has no use save to disguise an offensive breath and to

provide an agreeable addition to tooth powders. It is said to be employed in France in making issue peas, its odour, its slight acridity, and its swelling by the absorption of moisture rendering it suitable for the purpose. (See under IRIS.)—HENRY A. GRIFFIN.

ORTHINE, otherwise called *orthohydrazine-paraoxybenzoic acid*, seems to be an artificial alkaloid. The hydrochloride, a white powder soluble in water, is said to be a very powerful *antipyretic* in daily amounts of from 4 to 8 grains. Its use can not be recommended until further observations regarding it have been published.

ORTHOCHLOROPHENOL.—See under CHLOROPHENOLS.

ORYZA SATIVA.—See RICE.

OSMIC ACID.—The substance which is commonly known as osmic acid is osmium tetroxide (OsO_4), a perosmic acid. Of true osmic acid (H_2OsO_4), in the free state, nothing seems to be known. Perosmic acid is a volatile, odourous, crystalline substance, and is made by the action of hydrochloric acid on osmium or its lower oxides. It is readily soluble in alcohol and in ether, and dissolves slowly, but completely, in water. The aqueous solution is at first colourless, but on exposure to light it darkens and soon becomes black, the black osmic hydrate, the tetrahydroxide, $Os(OH)_4$, being formed. It is a powerful deoxidizing agent, and very irritating to living tissues, even when diluted with several parts of water. When the acid is brought in contact with the skin it produces a severe and painful eruption. The vapour of osmic (perosmic) acid acts as a violent irritant to mucous membranes, and when it is inadvertently inhaled the eyes, nose, larynx, and lungs suffer. In small quantities it causes increased lacrymation, coughing, and difficulty in breathing, and in excessive amounts it will cause death. The poisonous properties of osmic acid will be appreciated if we accept Deville's statement that "osmium is the most deadly poison known, a thousandth part of a grain, diffused through 100 cubic yards of air, being sufficient to poison all persons inhaling it; and no antidote for it is known" (Foster's *Encyclopædic Medical Dictionary*). The eyes seem to suffer greatly from exposure to the vapour of osmic acid, a severe and distressing conjunctivitis resulting, and it is thought that vision may be permanently impaired by the deposition of metallic osmium on the cornea. Barnell gives the symptoms of chronic osmic-acid poisoning in his own person. He made about two hundred experiments with the acid on animals, and as a result of prolonged exposure experienced "a feeling of weight and a sensation of cold in the back extending to the loins, pain in the region of the groins and testicles, swelling of the inguinal glands, loss of appetite, and malaise. These symptoms slowly disappeared when exposure was discontinued" (*Reference Handbook of the Medical Sciences*, art. Perosmic Acid). Raymond (*Progrès médical*, June 27, 1874) reports a case of apparently acute poisoning from osmic acid. The chief symptoms were inflammation of the eyes, a cutaneous eruption, indigestion, diarrhœa, and severe headache, and finally pneumonia, which appeared to be the immediate cause of death. At the autopsy the stomach was found the seat of considerable inflammatory reaction along its greater curvature. A chemical analysis revealed no traces of osmium (*ibid.*).

Claus has recommended careful inhalations of hydrogen sulphide as an antidote to poisoning from the vapour of osmic acid, but, as the antidote is a violent poison, "the remedy may be worse than the disease" unless great precaution is exercised in its use.

Osmic Acid as a Hardening and Staining Agent.—A 1-per-cent. solution of this acid kills the lower forms of animal and vegetable life almost instantly without distorting them, and hardens and preserves the tissues; it is thus a valuable agent to the microscopist in certain lines of investigation. By its selective action on certain tissues, and its power of turning fat black, it is a staining agent much prized in studying fatty degeneration in neuritis. The inconveniences experienced in the use of osmic acid in microscopy are its expensiveness and the readiness with which it deteriorates on exposure to light.

Therapeutics.—Wildermuth, in 1884, employed osmic acid in the treatment of *epilepsy*. It was given in the form of a pill containing $\frac{1}{64}$ of a grain, and repeated until the daily quantity amounted to $\frac{1}{4}$ of a grain. Stekonlis has alleged great success from injections of 15 minims of a 1-per-cent. solution of osmic acid deep into the region close to the sciatic nerve in obstinate cases of *sciatica*. At first the injections were made daily; later, every three or four days (*U. S. Dispensatory*). Dr. Schapiro (*Lancet*, Aug. 13, 1887) confirmed the value of the remedy in the treatment of sciatica. He used 5 minims of a solution composed of 1 part of osmic acid, 40 parts of glycerin, and 60 parts of water. Solis-Cohen, of Philadelphia (*Med. News*, April 6, 1889), has reported the cure of an obstinate case of sciatica by injections of a 1-per-cent. solution of osmic acid. The injections were made near the nerve, two or three times a week; the dose varied from 10 to 20 minims, and the treatment was continued about three weeks. Seeligmüller, in 1887 and 1888, reported the use of 1 to 10-per-cent. solutions in the treatment of *intercostal neuralgia*. The injections were made deep into the muscles along the spine, and gave sharp pain at first, followed later by relief. Grinevitski, in 1888, advised for *muscular rheumatism* injections of from 8 to 20 minims of a 1-per-cent. solution of the acid, thrown deep into the parenchyma of the affected muscle (*Ann. of the Univ. Med. Sci.*, vol. v, A–114, 1889). Dr. Carl Schröder employed the acid in pill form in eight cases of epilepsy. The daily quantity was about $\frac{1}{8}$ of a grain. Two of the patients showed some improvement, and the six others appeared to derive no benefit from the treatment (*Med. Annual*, 1891, p. 199). Auerbach has employed parenchymatous injections of osmic acid with alleged success in the destruction of *morbid*

growths (*Jour. of Laryngol. and Rhinol.*, June, 1891). Dr. Burton W. Swayze (*Med. Summary*, Dec., 1892) reports three cases of sciatica favourably influenced by daily injections of a 1-per-cent. solution of osmic acid.

The use of osmic acid as a therapeutic agent has not been very extensive, as the references just mentioned seem to be the principal ones relating to its employment in therapeutics. The results obtained from it in epilepsy have not been gratifying, but in certain cases of obstinate and intractable neuritis and muscular rheumatism, in which a local stimulant is needed deep in the affected tissues, a weak solution of osmic acid seems to meet the indications. The solution first recommended by Schapiro, consisting of 1 part of osmic acid, 40 parts of glycerin, and 60 parts of water, is probably the best. It will rarely occur that a stronger solution than one of 1 per cent. will be necessary, although a 10-per-cent. solution has been injected (Seeligmüller). This seems to be unnecessarily strong, and might set up a violent inflammation. The quantity of the weaker solution, to begin with, should not, as a rule, exceed 5 minims, but this may be gradually increased, as tolerance is established, to three or four, or even five times this amount. It seems safer not to employ the injections oftener than every second day, but the severity and duration of the reaction following each injection will form the best guide for the frequency of subsequent injections. An injection should not be repeated until all tenderness and soreness from the previous injection have passed away.

JEREMIAH T. ESKRIDGE.

OSMIUM HYDROXIDE, OSMIUM TETROXIDE.—See OSMIC ACID.

OUABAIN is a crystalline glucoside, $C_{30}H_{46}O_{12}+7H_2O$, obtained from an Abyssinian arrow-poison which is a concentrated extract of the wood of *Acocanthera ouabaio*, an apocynaceous tree. Ouabain is said to be identical with strophanthin. It is white, inodorous, slightly bitter, soluble readily in alcohol and in boiling water, and slightly soluble in cold water. Ouabain is a powerful cardiac and respiratory poison. According to Rondeau and Gleg (cited by Bocquillon-Limousin), 0·031 of a grain will kill a dog weighing twenty-six pounds in a few minutes. In minute doses, never reaching to daily amounts of more than 0·015 of a grain, it has been given to children affected with *whooping-cough*, and a favourable action has been noted; but it is too violent a poison to be recommended as a remedy for this disease.

OVARINE.—An extract prepared from the ovary (see under ANIMAL EXTRACTS AND JUICES).

OVI ALBUMEN, OVI VITELLUS.—See under Eggs.

OXALIC ACID.—This crystalline acid, $C_2H_2O_4+2H_2O$, is a violent *caustic* and *corrosive poison*, so violent, indeed, that a case of fatal poisoning with sorrel, which owes its sour taste to potassium oxalate, has been recorded (*Hosp. Gaz.*, June, 1886; *U. S. Dispensatory*, 17th ed., p. 1707). The minimum fatal dose, according to Taylor, is a drachm. Swallowed dry or in strong solution, oxalic acid immediately gives rise to horrible pain in the stomach and œsophagus, accompanied by retching. It does its work speedily, and the corrosive symptoms soon give place to fatal collapse. When diluted so as to show no corrosive action, the acid is still highly poisonous, acting as a paralyzer of the heart.

The treatment of *oxalic-acid poisoning* is that of poisoning with the other corrosive acids (see vol. i, page 6). As this acid and some of its salts (known as "salt of sorrel" and "salt of lemon") are extensively used as cleansing agents and to remove ink stains, iron-rust stains, etc., and as the acid crystals are exceedingly apt to be mistaken for those of Epsom salts, oxalic-acid poisoning is of frequent occurrence. The treatment must be prompt and assiduous. After washing out the stomach with a siphon, or emptying the organ by means of an emetic if no siphon is at hand, chalk or magnesia, mixed with water, should be given freely. If neither of these is readily to be obtained, lime, in the form of scrapings from a plastered wall, may be used. Afterward white of egg, milk, or some like bland substance may be employed as in poisoning with other corrosives.

For the toxic paralysis of the heart which results from the ingestion of solutions of oxalic acid too weak to be caustic, cardiac stimulants, such as digitalis, may be given, but there seems to be little hope of their proving efficient, in view of the radical destruction worked by the poison on the functional capabilities of nerve and muscle. This is well illustrated in an article on The Action of Oxalate Solutions on Nerve and Muscle Irritability and Rigor Mortis, by Professor W. H. Howell, of the Johns Hopkins University (*Jour. of Physiol.*, vol. xvi, 1894, p. 476). In the action of oxalate solutions upon muscle and nerve, Professor Howell says, there are certain points of resemblance which may be mentioned. In each, the irritability is quickly destroyed, but the tissue does not at once entirely lose the structure characteristics of organized matter. This is made probable by the fact that the nerve-fibre still shows a demarcation current, and the muscle-fibre is still capable of undergoing rigor mortis. The action of the oxalates, however, accelerates in each case the disorganization of the living structure of the tissue; rigor sets in more rapidly in the muscle, and the demarcation current disappears more quickly in the nerve. He thinks the important fact brought out in his experiments is that the action of oxalate solutions upon skeletal muscle may be carried far enough to completely destroy its irritability toward electrical stimulation without injuring or, at least, destroying its property of entering into the conditions of rigor mortis.

Oxalic acid is little if at all used in therapeutics. In 1886 a committee of the Paris Society of Therapeutics reported on a paper in which M. Poulet had proposed its use in *asth-*

ma, in daily amounts of 30 grains, dissolved in about 5 fl. oz. of vehicle. As this dose was considered dangerous, the committee reported adversely on the paper (*Gaz. hebdom. de méd. et de chir.*, May 7, 1886). Very soon an article by M. Poulet appeared in which he advocated the use of the acid as an *emmenagogue* and as a remedy for *dysmenorrhœa* (*Gaz. hebdom. de méd. et de chir.*, May 14, 1886). He recommended the following formula:

Oxalic acid.....	2 parts;
Warm water.....	200 "
Syrup of bitter-orange peel...	60 "

A teaspoonful to be taken every hour.

At the meeting of the Society of Therapeutics succeeding the one at which the report on M. Poulet's paper on the use of the acid in asthma had been received, M. Rougon (*Gaz. hebdom. de méd. et de chir.*, May 21, 1886), who had made the report, reviewed the subject of the advisability of admitting oxalic acid into the list of substances to be used medicinally. He spoke of its having been employed with favourable results as a palliative in cases of *strangulated hernia*, but, in view of its toxicity, 45 grains of potassium binoxalate ("salt of sorrel") having killed a person fifteen years old, he thought it unsafe to employ in the doses recommended by M. Poulet. As a matter of fact, oxalic acid has not come into use in medicine, although oxalate of cerium (see under CERIUM) is a recognised remedy.

OXALIS.—*Oxalis acetosella*, or common sorrel, has been used in infusion as a cooling drink. As it contains potassium binoxalate, a violent poison (see OXALIC ACID), its immoderate use, either as a medicine or as an ingredient of salads, etc., is not wholly free from danger.

OX-BILE, OX-GALL, *fel bovis* (U. S. Ph.), *fel tauri*, is the fresh bile of *Bos Taurus*, the ox. It is a green or brownish-green, viscid liquid of disagreeable odour and bitter, nauseous taste. Its composition is not entirely known, for biliary chemistry has thus far proved defiant of solution, but it contains what are known as bile salts and bile pigments, as well as cholesterin, urea, fats, mucus, and some inorganic salts. Crude ox-gall is not employed in medicine.

Purified ox-gall, *fel bovis purificatum* (U. S. Ph.), *fel bovinum purificatum* (Br. Ph.), is fresh ox-gall purified by filtration with the aid of alcohol and evaporated to a pilular consistence. It is a yellowish-green mass of peculiar odour and bitter and sweetish taste. It is freely soluble in water and in alcohol.

Ox-gall has the physiological properties of bile; that is, when in the intestine, it aids in the absorption of fats and peptones, it diminishes putrefaction, and it stimulates peristalsis. For these purposes it has been given in ailments in which biliary secretion is thought to be deficient. It may thus be serviceable in *habitual constipation*, in *intestinal dyspepsia*, and in *malnutrition* from inability to properly digest fatty foods, and it may be combined with cod-liver oil to aid in its assimilation. It is not a remedy which is extensively employed, for it is not effective as compared with others, and it must be confessed that even if it were effective its use would not be altogether rational, for certainly it would serve to palliate rather than to cure. Ox-gall has the serious disadvantage, too, of interfering with gastric digestion. If it is used, therefore, it should be at a time sufficiently remote from the taking of food, and it is well to administer it in a capsule. The dose of purified ox-gall is from 5 to 10 grains.

[Ox-gall enemata have been thought to be of value as a solvent of hardened fæcal masses in cases of *fæcal impaction*. The enemata should be large and should be retained by the patient for a considerable length of time.]

HENRY A. GRIFFIN.

OXYGEN is a chemical element. It is the most active of electro-negative substances. Under ordinary terrestrial conditions free oxygen assumes the gaseous state, but under great pressure, combined with extreme cold, may be liquefied and even solidified. Oxygen gas is colourless, tasteless, and odourless. Its density is a little greater than that of air, being 1·10563. The density of liquid oxygen at —140° C, under a pressure of 530 atmospheres, is 0·9787—that is to say, a little less than that of water. At 0° C, under a pressure of 0·76 metre, a litre of air weighs 1·2930 gramme. Under the same conditions of temperature and pressure a litre of oxygen weighs 1·4298 gramme. Oxygen is but slightly soluble in water, which at ordinary temperatures will take up about 4·6 per cent. of its volume.

Biological Relations.—Oxygen is separated from carbon dioxide in the atmosphere by plants, which retain the carbon and give off oxygen, animals complementarily absorbing oxygen and giving off carbon dioxide. Physiologically, it is thus of the greatest importance, its free supply to the respiratory organs being absolutely essential to the maintenance of life. Entering the alveoli of the lungs by way of the bronchi, trachea, larynx, mouth, and nostrils, it unites with the hæmoglobin of the blood to form oxy-hæmoglobin, carbon dioxide being given off at the same time. This change, effected in the capillaries of the lungs, marks the conversion of dark, or venous, into bright, or arterial, blood. The volumes of oxygen and of carbon dioxide absorbed and given off respectively are proportional, being dependent upon the chemical and physical relations of the two gases. By the blood, oxygen is given up in part to the cruder products of digestion, but more largely to the fixed tissues by which it is made use of in the development of energy, combining with their constituents to form a number of products—nutrient, functional, and excretory. The final results of vital oxidation are chiefly carbon dioxide and water, although certain quantities of urea, uric acid, and other products of the oxidation of food and tissue are excreted without further reduction. While the whole subject is still obscure and in dispute, it seems to be reasonably demonstrated that some of the toxic metabolins giving rise to symptoms of disease are the results of im-

perfect oxidation. It is estimated that about one fifth of the oxygen contained in atmospheric air, as ordinarily inhaled, is absorbed into the blood, combining with the hæmoglobin, the four other fifths being returned to the atmosphere in the expired breath.

Medical History.—Attempts to use oxygen in therapeutics were made by Priestley, its discoverer, and by his contemporaries, of whom Beddoes has contributed observations of the greatest value to medicine. From Priestley's day to the present, oxygen has been much abused by charlantry and by honest ignorance. The name has a decided hold upon the imagination, and sufferers and hypochondriacs are ready to welcome it as a remedy for every imagined and imaginable ill. The facts that the inhalation of oxygen produces a temporary exhilaration in almost every instance, and that certain cases, both of chronic and of acute affections, are really benefited by such inhalation, render it easier for pretenders to deceive their clients, and for physicians, ignorant of the true field of usefulness of the remedy and of its limitations and dangers, to deceive themselves.

Preparation and Administration.—Oxygen may be extemporaneously prepared for medical use in many ways, for the details of which chemical treatises may be consulted. The best is by gently heating in a suitable retort a mixture of 4 or 5 parts of potassium chlorate and 1 part of manganese dioxide. Purity of the ingredients is essential, not only to avoid contamination of the product, but to prevent accident in the preparation. The gas as evolved should be passed through three wash-bottles containing water, and to the first of them should be added about ½ per cent. of potassium hydroxide, and to the second about ½ per cent. of silver nitrate to absorb any free acid or chlorine that might be given off. The last washing should be with pure water. The apparatus designed by Dr. Wallian is the best in the American market. The gas may be collected in a suitable gasometer and kept for a short time, or in rubber bags and used promptly. Another method of preparing it, which has come into vogue within recent years, since pure hydrogen dioxide has been more readily obtained in the shops, is to allow a solution of potassium permanganate, 8 grains to the ounce, to drip slowly into a solution of hydrogen dioxide contained in a Woolf bottle or other suitable receptacle furnished with two openings for the ingress and egress tubes, the latter, to which the mouthpiece is attached, not being allowed to pass more than about an inch below the stopper. A plan even more convenient is to introduce into a long-necked flask of about 4 oz. capacity, stopped with rubber and furnished with an air-tube and mouthpiece (see figure), 2 oz. of the official solution of hydrogen dioxide, and pour upon it an equal quantity of boiling water. To this should then be added half a teaspoonful of washing soda (sodium carbonate) as free from lumps as possible. Oxygen will be disengaged and bubble slowly through the fluid.

Sir Benjamin Ward Richardson believes what he terms "ethereal oxygen" to be one of the most useful of his many contributions to our resources. In a two-necked Woolf bottle, one neck of which is furnished with a delivery tube and a valved mouthpiece, he places 2 oz. or more of "ozonic ether" (which is a 30-volume solution of hydrogen dioxide in ether), pours through a funnel in the other opening 1 oz. of a solution of potassium permanganate (8 grains to the ounce), and then corks that opening while the patient inhales ether and oxygen through the mouthpiece (*Asclepiad*, vol. ix, 1892, p. 167). He has also shown the usefulness of oxygen as a carrier of other vapours than ether, such as ethylene, chloroform, methylene, methylal, amyl nitrite, ammonia, iodine, bromine, benzoin, turpentine, and volatile oils. The oxygen may be freshly evolved from hydrogen dioxide in a flask containing the volatile substance on or in the dioxide solution, or a gentle current of oxygen from any convenient reservoir may be passed through the medicated solution into the inhaler. When water is not admissible, the volatile substance—say iodine or turpentine—is placed in a good-sized flask with a double neck, and the oxygen simply flows over it on its way to the inhaler. Another method is to charge an elastic receiver with oxygen that has passed over the volatile medicament, and to have the patient inhale directly from this a fixed quantity. Clover's (chloroform) inhaling bag and the cellulite valved mouthpiece of Richardson are the best for use in this manner. A convenient method for the administration of oxygen much in vogue at the present day is to store the pure gas (prepared from potassium chlorate and manganese dioxide, or from atmospheric air, and properly washed), or oxygen mixed with nitrogen monoxide in various proportions, in stout metal cylinders under greater or less pressure, according to the size of the cylinder in which it is desired to hold the given volume. Under a pressure of 1,800 lbs. to the square inch, 40 gallons may be stored in a cylinder 3 inches by 12⅓ inches, weighing 11 pounds. It will have a purity of 95 to 96 per cent., being diluted by the small quantity of air in the cylinder. From the cylinder the gas may be drawn into rubber balloons and inhaled (passing through water in a wash-bottle on its way to the mouthpiece), or the wash-bottle may be attached by tubing directly to the cylinder. A special apparatus for the administration of oxygen by rectal injection (or insufflation) has been devised. The

writer has had no experience with this method of administration.

Physiological Effects.—Inhaled undiluted, oxygen causes subjectively a sensation of warmth in the mouth and air-passages, and there seem to be lightness and ease in respiration, sometimes in mental processes likewise. Objectively, there is acceleration of the pulse with increased hardness, indicating a rise of blood-pressure from increased force of the cardiac action. Warmth of the cutaneous surface is usually observed. The visible mucous membranes, sometimes the cheeks as well, are heightened in their red colour. Sometimes there is increased moisture of the skin. The respirations are usually increased in frequency at first, but subsequently the depth increases and the number diminishes. If the inhalation is continued for too long a time, violent mental and physical excitement, with rise of temperature, may be produced. This is marked in small animals, such as the mouse, guinea-pig, cat, and dog kept in an atmosphere of undiluted oxygen. In such animals death may occur in a few hours and all the viscera be found congested or inflamed. Such effects are not common in human beings inhaling oxygen for medicinal periods, except in the case of subjects of pulmonary tuberculosis, in whom increased inflammation and febrile movement may result from the inhalation of oxygen, as was long ago pointed out by Beddoes. In the researches of Sir B. W. Richardson (*Asclepiad*, vol. iv, 1887, pp. 71 and 172) concerning the effects of oxygen upon lower animals, the process of manufacture of the oxygen used seemed to make a difference, probably due to the admixture of ozone in some cases. Temperature exerted a marked influence, oxygen at 20° or 125° F. becoming practically a narcotic poison. The range of temperature most favourable to life was from 55° to 90° F. Between these temperatures and the extremes before noted an anæsthetic effect was produced. The degree of concentration of oxygen in the factitious atmosphere was also found to modify the effect. Life could be sustained longer in an unchanged atmosphere of diluted oxygen than in the pure gas, the most favourable mixture being that found in ordinary air, one part of oxygen to four parts of nitrogen. Important differences were noted in the reactions to oxygen of cold-blooded and of warm-blooded animals, the former being little affected, while among the latter differences of effect in different species were observed, the rabbit, for example, resisting the pyretic and phlogistic influences. Perhaps the most striking result obtained by Richardson is that dependent upon the difference in the effect of breathing a still atmosphere of pure oxygen and that of breathing pure oxygen in current. In the former case, after the stage of excitement, narcosis and death ensue in the course of a few hours; in the latter case the animal continues to live for days. That this is not due to accumulations of carbon dioxide is proved by making provision to absorb it; and even when all other products of respiration are removed, the oxygen that has been breathed and rebreathed for some time, while still able to support combustion, is unable to support life. "Devitalizing oxygen" may, however, be made "vitalizing" again by the effect of an electric discharge (cf. Ozone). These facts indicate a source of danger in crowding and lack of ventilation apart from those commonly recognised.

The physiological effects described are usually transient, but after repeated inhalations certain permanent effects begin to be manifest in addition. There are increase of appetite and increased ingestion of food, with consequent gain in weight. The number of red corpuscles in the blood and the relative as well as the absolute hæmoglobin percentage are augmented. The excretion of uric acid diminishes and that of urea probably increases; observations upon the urinary excretion are, however, conflicting.

Applied to the unbroken skin, oxygen is practically without effect, perhaps increasing the exhalation of carbon dioxide. When, however, the gas is allowed to come in contact with wounds or ulcerated surfaces, it produces immediate and painful irritation, accompanied with increased redness and abundant liquid exudation; granulations increase, and, if the process is too long continued, become ecchymotic and lose their tendency to cicatrize. Oxygen may be introduced beneath the skin, in the form of gas or held in loose combination as hydrogen dioxide, without danger. As hydrogen dioxide, it may be injected into the pulmonary tissues through the chest wall, and it is said that with caution oxygen gas may safely be injected into the veins. It has been passed into the stomach through a suitable tube. However introduced, it is readily absorbed, and produces its effects primarily upon the tissues and blood locally, secondarily upon the organism as a whole.

Upon pathological conditions certain specific effects have been alleged for oxygen; thus its inhalation has been said to diminish the production of sugar in *diabetes* and to have proved capable of averting *diabetic coma* by the oxidation of products that would otherwise form diacetic and oxybutyric acids.

Therapeutics.—Oxygen may be applied to the skin or mucous covering of the body, or introduced into the blood by way of the lungs. Solution of hydrogen dioxide (*q. v.*), given by the stomach, or with due caution subcutaneously, has also been supposed to yield oxygen to the blood. It has been used as a stimulating application to *indolent ulcers*, and has been said to promote their repair. It has also been used in cases of *infected wounds*, and especially when there have been *sloughing* and *gangrene*, for the purpose of destroying foul odours and preventing putrefaction. The charcoal-and-oxalic-acid poultice is supposed to be of advantage by virtue of the oxygen which it slowly gives off. Hydrogen dioxide is also supposed to owe much of its undoubted therapeutic value to the fact that upon being brought into contact with decomposing organic matter, with pus and other morbid products, it liberates oxygen in the active

(nascent) state. Day (*Australian Med. Journal*, July, 1878, p. 183) prepares dressings by saturating cotton with terebinthinate oils and exposing them to the air, hydrogen dioxide being thus generated. A useful formula is the following: Very old turpentine, 1 part; benzine, 7 parts; oil of verbena, 5 drops to the ounce. Eucalyptus oil is also useful: 1 part of eucalyptus to 4 of benzine makes a good disinfecting mixture, readily yielding its oxygen.

[Stoker (*Med. Press and Circular*, Apr. 17, 1895; *Therap. Gaz.*, Aug., 1895) states that in the local treatment of *wounds* and *ulcers* the oxygen may be diluted with pure air, according to the requirements of each case. It is not necessary that an absolute vacuum should be brought about. When the treatment is to be applied to the extremities it is necessary to have rubber bags of the simplest construction. If to the knee, for instance, what is required is an oval rubber receptacle open at both ends, larger at one end than at the other. The lower or smaller end of the bag embraces the limb below the knee and the upper or larger end embraces the limb above the knee. When this rubber receptacle is used it is not necessary to have a continuous stream. The bag should be filled and the tap turned off, and after five or six hours it should be filled again. Such bags may be made to include any part of the body. The method of procedure is as follows: First the wound is washed, then the rubber cap is placed so as to embrace the part. The bag is then filled with oxygen diluted with air. Pure oxygen causes a great deal of pain, but some patients stand it well. A 50-per-cent. mixture is commonly employed, diluted with purified air; this is passed through two wash-bottles before entering the gas-bag, the first containing limewater, and the second a strong solution of Condy's fluid; then the oxygen is passed into it out of a cylinder. When the bag is to be refilled it is connected with the receptacle by a small tube, the tap is turned partially on, and the oxygen-container is refilled as often as is necessary. There is usually immediate relief from pain. For the first twelve hours the micro-organisms do not differ in number or character, but after that the discharge diminishes and the germs show remarkable changes. In one of Stoker's cases, in addition to lesions in other parts of the body, there was a *tuberculous ulcer* on the back of the hand, involving nearly all the dorsal surface. Other cases were of *tuberculous disease of the tibia*, of *tuberculous synovitis*, and of *syphilitic rupia* of the head.]

By inhalation oxygen is used either pure or diluted with air or with nitrogen monoxide in various proportions. Its principal employment in the hands of educated physicians has, unfortunately, been in the treatment of *pulmonary tuberculosis*, in which disease it is rarely useful and usually harmful. This fact, first pointed out by Beddoes, was independently observed by Fourcroy, and has been confirmed by the studies of J. Solis-Cohen (*Inhalation*, etc, 2d ed., Philadelphia, 1876, p. 77) and by those of the writer. It should not be understood, however, that the inhalation of oxygen is at all times and under all circumstances to be avoided in the treatment of pulmonary tuberculosis. Under certain circumstances it has considerable palliative value; but it should be distinctly recognised that it is palliative only, to be used for temporary purposes, and for short periods as a stimulant, or to relieve dyspnœa. The combination of one third oxygen and two thirds nitrogen monoxide is usually the best for employment in this manner, as the nitrous oxide diminishes the untoward activity of the oxygen. Toward the end of life in pulmonary tuberculosis oxygen assists in smoothing the passage to the grave. It is of use in *hypochondriasis* and *neurasthenia* as a stimulating agent, and especially in cases of *neurotic dyspepsia* attended with perverted gastric secretion. In *chronic gastric* and *gastro-intestinal catarrh* oxygen given by inhalation and applied locally through a stomach-tube, *oxygenated water*, and *hydrogen-dioxide solution* have been used with benefit. Oxygen is a useful palliative in *gastric carcinoma*. It sometimes relieves the *insomnia* due to auto-intoxication, and especially when this is remotely due to *mental fatigue*. It is of benefit in *rhachitis*, in the *scrofulosis* of children, in *debilitated states*, in *gout*, and in *diabetes*. As a palliative in *asthma* during the attack it is of service, though not often successful in cutting short a paroxysm. In *chlorosis* and the *anæmias*, even in *pernicious anæmia* and in *leucæmia*, it is of distinct service. In *acute lobar pneumonia* it has often saved life. The administration of oxygen in this affection is rational, because the diminution in lung surface requires a concentration of respiratory pabulum. Nascent or at least recently prepared oxygen is preferable because it exerts antiseptic powers. Resort to oxygen should not be postponed until the patient is moribund. The inhalations should be regular and continuous, not sporadic and spasmodic; and should the patient be unconscious or unable to assist, the delivery nozzle should be inserted into the nostril and the gas allowed to flow in a continuous current at a gentle rate.

In acute obstructive diseases of the air-passages, such as *croup* and *laryngeal diphtheria*, before or after intubation or tracheotomy, in the *capillary bronchitis* of children, in the *catarrhal pneumonia* of the aged, and in acute diseases attended with *prostration* or *collapse*, such as *cholera asiatica*, *cholera infantum*, severe cases of *measles* and *scarlatina*, the terminal stages of *typhoid fever* and *puerperal* and other forms of *sepsis*, inhalations of oxygen will always afford comfort and prolong life, and may sometimes greatly assist recovery. In connection with artificial respiration oxygen is a potent agent in the treatment of *asphyxia*. In *toxic narcoses*, especially those brought about by *carbon dioxide*, *coal gas*, *opium*, *belladonna* and its congeners, *chloral*, *ether*, *chloroform*, and similar agents, if resorted to in time and used persistently, it may save life.

[The value of oxygen in *coma* has been well illustrated by Dr. Charles J. Macalister, of

Liverpool (*Clinical Sketches*, Jan., 1896; *N. Y. Med. Jour.*, Feb. 15, 1896), who describes two cases. The first case was that of a man, thirty-nine years old, who had pains in his limbs, severe headache, and frequent vomiting, which had been attributed to a series of exposures to cold and wet. He had an alcoholic appearance. The urine was diminished in amount, and contained more than a quarter of albumin. The temperature was normal. Two days after he entered the hospital he seemed drowsy and complained of spots floating before his eyes. The respiration was hurried and the pulse was 82. There was severe frontal headache, with some vomiting; the bowels moved freely. In the afternoon the patient became delirious, and later on he was found to be absolutely blind. The temperature was 100·8° F.; the pupils were very much contracted, with no reaction to light; there were no muscular twitchings. Early in the evening he became semi-comatose; the breathing was loud and stertorous, and the lips, the nose, and the extremities were somewhat cyanosed. The temperature was 101° F. Two hours later he was in a profound coma; his eyes were open and the pupils were contracted to pin-points; the muscles were relaxed, the extremities were cyanosed, the mouth was closed, and the heart beat tumultuously. The pulse was 118; there was œdema of the extremities. The patient was insensitive to pain and was apparently under the influence of some poison which interfered with oxidation. Dr. Macalister administered oxygen freely, pure oxygen through one nostril and air through the other. The results were very striking, for the face and the lips rapidly became less cyanosed, and in ten minutes the patient tried to push the tube from his nose. The pulse was at once reduced from 118 to 96. The respirations became slower and freer from stertor, and the pupils were less contracted; the corneæ were sensitive. Later on the patient turned voluntarily on to his side, but no replies could be elicited to questions. A cupping-glass was then applied over the loin, and the pain effectually aroused him. He sat up in bed and became so violent that assistance was necessary to restrain him, although he took no notice of any questions put to him and made no attempt to speak. He presently relapsed into a drowsy condition, for which the administration of the oxygen was repeated, and ten minutes later he sat up and asked for a drink. There was no return of unconsciousness, although two days later there was a threatening of it, which was averted by the oxygen. In twenty-four hours the urine measured 108 ounces, and contained an eighth of albumin, with hyaline and granular casts; the specific gravity was 1·005. Four days later the patient was able to see; the ophthalmoscope showed small hæmorrhages, especially in the left fundus. A few days afterward the headache disappeared and the albumin rapidly subsided. A week later the man left the hospital perfectly well. The second case was one of morphine poisoning, and the cure seemed to have been accelerated by the use of oxygen.]

The most recent advance in the therapeutic use of oxygen is the application in surgical anæsthesia of Sir B. W. Richardson's suggestions as to the use of oxygen as a menstruum for ether and chloroform. Cole, of New York (*Med. Record*, Oct. 16, 1895), seems to have been the first to put the plan into actual operation. The writer has adapted the ordinary face-mask of his compressed-air apparatus to this purpose by the addition of an expiration valve. From a cylinder of compressed oxygen the gas is passed through a wash-bottle containing the anæsthetic into the mask. By this plan, which has been adopted in the service of Dr. T. S. K. Morton at the Philadelphia Polyclinic Hospital, anæsthesia is produced without suffocation or struggling, may be prolonged with less ether and continued with less cyanosis and less danger, and recovery (which is aided by the inhalation of pure oxygen) is more rapid and without distress.

[At a meeting of the New York Surgical Society held on November 27, 1895 (*Annals of Surgery*, Feb., 1896), Dr. Francis H. Markoe read a paper on the use of oxygen with ether for anæsthesia. He said that the use of oxygen prevented the cyanosis that was so common when ether alone was employed; and that if anæsthesia was induced by oxygenated nitrous oxide it could be most satisfactorily and safely prolonged with oxygenated ether. It had been suggested also that chloroform anæsthesia might be made safer with oxygen.

In the discussion which followed the reading of Dr. Markoe's paper, Dr. Robert Abbe said that, so far as his limited experience with the method went, it seemed to show that it possessed advantages. That there was a gain in oxidation during etherization could not be questioned. The patient's complexion was pinker, the blood in the wound was more arterial, the minute arteries seemed to spurt more, but the blood clotted quickly, so that there was no greater hæmorrhage. Its use had been attended by less secretion of saliva and a less abundant production of mucus in the bronchi than where ether alone had been employed. The patients had experienced less nausea subsequently, and the effects had been pleasanter. In a case of mitral lesion which had caused much anxiety, the patient had borne the anæsthesia and a long operation very well, and had experienced no nausea.

Dr. B. Farquhar Curtis said he had tried the method in about ten cases, and must say that he had not witnessed much improvement over older methods. There had been cyanosis in some of his cases, whereas he had supposed that cyanosis was the principal disagreeable symptom which could be prevented by the use of oxygen. The stage of excitement had been quite prolonged in some of his cases, and there had been nothing in the history of the patient to account for it. In some cases he had observed want of efficient anæsthesia, and he suspected that it was due to the diminished quantity of ether inhaled when administered in this way. The effects on the blood seemed to be about as described by Dr. Markoe, but perhaps this advantage also was

due to the fact that the patient got less ether. In a case in which he had kept the patient waiting about two weeks to get rid of a bronchitis before submitting to some trivial operation, it had been noticeable that there was absolutely no irritation of the bronchi after the operation, although there had been râles only two or three days before. He would warn the profession against the use of oxygen with nitrous oxide. He had tried it experimentally over and over again, and had found that the oxygen had no effect whatever, except in diminishing the anæsthetic influence of the nitrous oxide.

Dr. W. W. Van Arsdale agreed with Dr. Markoe that the ideal anæsthesia of the future would probably begin with nitrous oxide and be continued with ether. He had used this form in private practice for two years, and had been fortunate in having an experienced administrator assist him. By giving pure nitrous oxide and afterward substituting plain ether the patient could be placed remarkably, alarmingly quickly under anæsthesia, sometimes in half a minute, and without any disagreeable sensations or period of excitement, and without any of the after-effects following the use of ether alone. He had had no experience with the use of ether mixed with oxygen. It impressed him as a step in the right direction, but he feared that clinically it would meet with some objection. More ether had to be given, which was not a desideratum; if there were less cyanosis, that would be an advantage in itself.

Dr. Howard Lilienthal had used nitrous oxide at the beginning of anæsthesia and had been almost alarmed at the rapidity with which the patient became anæsthetized. A method which would do away with cyanosis would rob us of one of the danger signals. He added that this mixture of oxygen and ether was probably highly inflammable, if not explosive, and therefore should be used with extra precaution.

Dr. Andrew J. McCosh had used the combination of oxygen and ether in eight or ten cases, and had found the chief objection to lie in the fact that it was difficult to bring the patient under the influence of the anæsthetic, and relaxation had not been complete. During the greater part of the time before unconsciousness the patient was in a jolly mood. There was an absence of the distress which ether usually caused, there was no cyanosis, and the blood was well aerâted. Some years ago the method had been extensively employed, the tube conveying the oxygen passing into a cone made of paper and a towel, but after having been used in fifty or sixty cases the method had been abandoned. Regarding the combination of nitrous oxide and ether, it was rather troublesome, and, unless the anæsthetizer was a man of experience, the patient was apt to regain consciousness when the change was made from nitrous oxide to ether.

Dr. Markoe believed with Dr. Van Arsdale that the future method would be to induce anæsthesia with nitrous oxide, but he thought it would be modified with oxygen.

Dr. I. N. De Hart, of Brooklyn (*Boston Med. and Surg. Jour.*, April 16, 1896), who has reported a number of cases in which he has used oxygen in conjunction with an anæsthetic, says that pure oxygen should not be used with ether, on account of its tendency to counteract the anæsthetization or make it a very slow process; but it may be used with chloroform. He has found that oxygen diluted with 33 per cent. of nitrous monoxide or atmospheric air is the best form of gas to be used in producing anæsthesia, with either ether or chloroform, during surgical operations.

The amount of oxygen used during the operations which he reports averaged about a gallon a minute during the etherization, and afterward it was given with less pressure during the operation. The amount of ether consumed by an adult averaged about 4 ounces an hour, and he presumes it would require about half that quantity for a child. Of chloroform, from 2½ to 3 drachms an hour were used. Of the A. C. E. mixture about 4 ounces were used in an hour and forty minutes in one case. In another case only 8 ounces of ether were consumed in two hours and a half. The longest time required to produce complete anæsthesia with ether and oxygen gas (diluted) was fourteen minutes; the shortest time with the same anæsthetic, seven minutes. With pure oxygen etherization with ether requires from twenty to twenty-five minutes, and then it will sometimes require the giving of ether with a cone and dispensing with oxygen gas for two or three minutes. With chloroform and oxygen gas (diluted) the results are far more satisfactory, and anæsthetization is very rapid, usually requiring about two or three minutes.]—Solomon Solis-Cohen.

OXYMELS.—These are mixtures containing honey and some dilute acid, used mostly for their agreeable flavour. The *oxymel* of the Br. Ph. is composed of 8 parts of clarified honey and 1 fl. part each of acetic acid and distilled water. It may be used as a *refrigerant* in doses of from 1 to 2 fl. drachms.

OXYNAPHTHOIC ACID, $C_{11}H_8O_3$, formed by the reaction of an alkaline compound of α-naphthol on carbon dioxide under pressure at a high temperature, is a colourless crystalline substance hardly soluble in water, but fairly soluble in alcohol, in ether, and in oils. It is poisonous and is not used internally, but has been proposed as a topical *antiseptic*.

OXYQUINASEPTOL. — See Diaphtherin.

OXYSPARTEINE.—This derivative of sparteine has been found by Langlois and Maurange (*Gaz. méd. de Paris*, Aug. 24, 1895) more active than sparteine as a *cardiac stimulant*. The dose of the hydrochloride, administered subcutaneously, is from ½ to ⅔ of a grain.

OXYTOCICS.—This term, in the broadest sense, includes all measures which hasten parturition by increasing the strength of the expellent forces, especially of the uterine contractions. Such agents are also sometimes

designated as ecbolic, ocytocic, ocyodinic, or oxytoceous agents.

The unstriped muscular fibres of the uterus are apparently capable of rhythmical contraction independently of the action of the general nervous system. Yet at the same time they are under the control of nerve-centres in the spinal cord and the brain. The spinal centre is situated in the lumbar portion of the cord, and the uterine contractions go on normally after the cord has been divided above the lumbar region. This lumbar centre may act independently of the cerebral centre, or may be excited by it. The mode of action of ecbolics is not yet fully understood. While their effects are in the main due to stimulation of nerve-centres, some of them also possess to some extent the power of directly causing contraction of the uterine muscle fibres.

Under the foregoing definition there are two classes of ecbolic measures, medicinal and mechanical. Of drugs, there is a long list which have been credited with the power of stimulating the uterine contractions during labour. Chief among these are ergot, hydrastis, cimicifuga, thuja, mistletoe, ustilago maidis, borax, cottonwood, savine, rue, tansy, wormwood, apiol, yew, pennyroyal, black hellebore, quinine, sugar, digitalis, squill, laburnum, grains of paradise, guaiacum, salicylate of sodium, oil of amber, pilocarpine, belladonna, phosphorus, strychnine, broom-fern, lignum vitæ, hoarhound, chamomile, mugwort, cantharides, juniper, juice of bamboo, milk hedge and other euphoriaceous plants, chiretta, carrot seeds, sassafras, arsenic, corrosive sublimate, cyanide of potassium, sulphate of copper, drastic cathartics, and the inhalation of carbonic oxide, of illuminating gas, or of the vapour of carbon disulphide. Most of these drugs exert but a feeble influence upon the uterine contractions, and are of no practical importance as oxytocics. A few deserve special mention.

Ergot is an agent of undoubted power as a uterine excito-motor. It intensifies the uterine contractions when they are already established, and is capable of exciting them primarily in the gravid uterus. In large doses it produces a tonic contraction of the uterus. The intervals between the contractions are nearly or quite obliterated, the organ remaining in a state of spastic rigidity. Under smaller doses the action of the uterine muscles is intermittent, but the relaxation is not so complete as in spontaneous labour. In very small quantities (10 minims of the fluid extract) the effect is to produce contractions very closely resembling those of natural labour. The pains are rendered more frequent and more energetic. The use of ergot, however, for the purpose of accelerating labour is generally condemned by obstetric authorities. The nearly continuous contraction of the uterus under full doses of the drug interferes with the utero-placental circulation and is frequently fatal to the child. Violent ergotic contractions are dangerous to the mother as well, exposing her to the risk of uterine rupture. While ergot in very small doses may no doubt be given to advantage in *inertia uteri*, it is usually inferior to other means and the practice is seldom to be recommended.

Hydrastis canadensis is a powerful ecbolic. Its action is believed to be of centric origin, since it ceases on section of the uterine nerves. The dose of the fluid extract is from 5 minims to ½ fl. oz. *Hydrastine*, the dominant principle of hydrastis, may be substituted for the drug itself. The dose is from ⅛ to ¼ of a grain. *Hydrastinine* is an artificial alkaloid produced by acting on hydrastine with oxidizing agents. It is an active oxytocic. In full doses, like ergot, it produces violent uterine tetanus. (See vol. i, p. 475.)

Quinine has the power to intensify contractions of the uterus already established; possibly in some cases that of originating them. Probably it acts more by rousing the general nervous system than by its direct effect on the uterus. However that may be, the writer has seen abundant evidence of its value in stimulating the flagging pains of labour. A single dose of 10 grains usually suffices.

Sugar has recently been added to the list of ecbolic agents. It is given in doses of about an ounce dissolved in water. Its effect on the pains is manifest in from twenty-five to forty-five minutes. Rarely is a second dose required. The contractions induced by sugar are said to be of the usual normal character.

Cotton Root.—The fluid extract of cotton root exerts a pronounced oxytocic influence. It is open to substantially the same objection as ergot. The dose of the fluid extract is ½ fl. drachm.

Cimicifuga has been employed as a uterine stimulant during labour. It produces normal, not tonic, contractions. The fluid extract is the best preparation. It is given in doses of from ½ to 1 fl. drachm three or four times daily. Of the tincture, from 1 to 2 fl. drachms may be given with the same frequency.

Electricity is one of the most reliable ecbolics. The faradaic or the interrupted galvanic current is used. To avoid injury to the fœtus, the current must not be too strong, and it should not be passed directly through the child's head. One electrode may be applied to the sacro-lumbar region and the other over the middle of the abdomen. The current should be mild at first and increased gradually, to guard against over-stimulation and consequent destruction of the electro-muscular contractility. Each application may last from five to thirty minutes.

Before the escape of the waters the introduction of an aseptic English bougie between the fœtal membranes and the uterine wall may be practised for accelerating labour, as it is for inducing it.

Glycerin, injected between the ovum and the uterus, has recently been much employed for the induction of labour. It is most effective when carried high up into the uterus, and retained for a time by the aid of the lateroprone posture. It is believed to act partly as a direct irritant and partly by the separation of the membranes and by its osmotic effect. Labour is in most cases promptly established. In numerous recorded cases, however, the in-

tra-uterine injection of glycerin has been followed by hæmoglobinuria, with evidence of glomerulo-nephritis and even of interstitial hepatitis. Pelzer, by whom the method was introduced, still regards it as a safe procedure provided the quantity of glycerin injected does not exceed half an ounce.

The alternate use of *hot* and of *cold applications* to the abdomen during labour is a powerful stimulant of uterine contractions. In the first stage of labour standing or walking, and in the second sitting erect, are useful postural measures. A semi-recumbent or a squatting posture favours the expulsive efforts. *Hot rectal* or *vaginal douches* increase the strength and frequency of the pains. *Mammary irritation* is a well-known reflex stimulant of uterine contractions.

It is especially necessary in slow labours that the bladder and the rectum be kept empty. When these viscera are distended the uterine efforts are partially inhibited. Misdirection of the uterine axis should be corrected. A firm *abdominal binder* is frequently a material help during the second stage of labour, especially in *relaxed conditions of the abdominal walls.* While it does not increase the energy of the uterine contractions, it adds to their efficacy by furnishing a *point d'appui* for the intra-abdominal pressure.—CHARLES JEWETT.

OYSTER SHELL.—See TESTA PRÆPARATA.

OZONE.—Chemistry.—Ozone is allotropic oxygen. Its molecule contains three atoms instead of the two atoms forming the molecule of ordinary oxygen. Its formula is written as O_3, or sometimes as O_2O. It combines energetically at ordinary temperatures with nearly all oxidizable substances. Moisture favours its action. In forming combinations it yields the additional atom of oxygen, the remaining atoms resuming the ordinary form of O_2. This residue of uncombined oxygen occupies the same volume as the original ozone, which was therefore condensed. The density of ozone has been experimentally shown to be 24, or half as much again as that of oxygen, and its molecular weight 48, or three times that of oxygen. It has been separated from oxygen only in minute quantities, and in medicine ozonized air is the agent ordinarily employed to produce the effects of ozone. As a rule, 50 per cent. is the highest proportion of ozone that can be obtained in mixture with oxygen, and readily available apparatus produce much less. Heated to 300° C. (572° F.)—some say 250° C. (482°F.)—ozone reverts to the condition of ordinary oxygen with corresponding expansion in volume. It may be liquefied by cold and powerful pressure (from 150 to 125 atmospheres). Liquid ozone has a blue colour, it boils at 106° C. (222·8° F.)—some say 159° C. (286·2° F.)—and, if it is inclosed in a glass tube, changes to blue gas, which may again be liquefied by cooling.

Preparation and Properties.—Schönbein, in 1839, proved that the characteristic phosphorus-like odour accompanying electric discharges was due to a gas developed in and from the air by the chemical effect of the discharge, and on account of its odour he gave to this new gas, afterward shown to be modified oxygen, the name by which it is now known. The best means of preparing ozone in large quantities is to pass air or oxygen through a narrow dielectric space between two parallel conductors, as by means of a Siemens's induction tube or some similar device connected with a Holtz electric machine or a powerful Ruhmkorff coil, the silent discharge being more effective than the spark. Houzeau's apparatus consists of a glass tube about 0·1 of a millimetre in calibre and from 40 to 45 centimetres in length, containing a stout platinum filament, and wrapped around with a spiral of some good conducting material, such as copper wire. One of the rheophores of the induction coil is connected with the platinum wire, the other with the copper spiral. The current of pure, dry oxygen gas is allowed to pass through the tube at the rate of a litre an hour. The quantity of ozone produced is the greater the lower the temperature, about 50 per cent. of the oxygen being converted into ozone at −88°. An effective machine based upon this principle but much improved in detail has been placed on the American market and has been described by Dr. W. J. Morton in the *New York Medical Journal* for June 23 and 30, 1894. The output of the machine is measured in milligrammes of ozone per minute, and the dosage regulated accordingly. To remove irritating and deleterious nitrogen compounds the ozonized air is passed through a wash bottle containing a solution of caustic alkali (sodium hydroxide or potassium hydroxide). When pure oxygen has been ozonized this procedure is obviously needless. As ozone is always formed in greater or less quantity when oxygen is liberated or takes part in a reaction, especially if the evolution of heat is prevented, various chemical processes of production are available. Thus, several pieces of stick phosphorus may be placed in a large flask and half covered with water; after some hours the flask will contain considerable ozone. A current of oxygen may be conducted over moistened phosphorus in a glass tube. Barium dioxide or potassium permanganate or a mixture of potassium permanganate and oxalic acid may be gradually added in small portions to cold sulphuric acid. Ozone may be allowed to diffuse through the air of an apartment, or (mixed with air or oxygen) may be collected over water in glass vessels. It can not be collected in rubber, as it quickly destroys organic substances. It is soluble in pure water in the proportion of 8·81 per cent., the larger part, however, being converted by the water into oxygen without the formation of hydrogen dioxide. It is soluble in oils, some of them taking up as much as 25 volumes per cent.

Essential oils and terebinthinates absorb ozone readily; they will also absorb oxygen from the air and convert it into ozone, becoming rich in ozone with long exposure. Ozone exists in moderate and variable quantity in the atmosphere. According to some authorities, it is the form in which oxygen exists in the blood

combined with the hæmoglobin, but this opinion must be said to lack demonstration. It is supposed that the ozone of the atmosphere arises in great part from the slow oxidation of organic matters in a state of decomposition. If the combination takes place with elevation of temperature, the ozone formed is immediately broken up.

Thunderstorms and silent electric discharges in the atmosphere, the evaporation of water, especially of salt water, and the respiration of plants, especially *Coniferæ*, are among the other sources of ozone in Nature. Its presence may be detected by the blue coloration which it brings about in tincture of guaiac, the decolorization of indigo, or the liberation of iodine from combination in potassium iodide, as demonstrated by the blue reaction of starch paper.

One source of fallacy in observation is the fact that most of the agents employed to detect atmospheric ozone react similarly to hydrogen dioxide, but, allowing for this, the production of ozone in Nature must be extensive, and its destruction almost equally so. It is the great natural purifier, attacking energetically putrefying materials and converting deleterious into harmless products, nitrous and nitric acids, water, hydrogen dioxide, and carbon dioxide. Schönbein showed that one part of ozone in 3,240,000 of air was sufficient to destroy the odour of decay in a vessel of 60 litres (about 127 pints) in which had been placed for one minute 120 grammes (about 4 oz.) of putrid meat, and later observers have abundantly demonstrated its deodorizing properties. (Fox, *Ozone and Antozone*, London, 1873.) Under ordinary conditions, it does not, however, destroy bacteria, moisture of the ozone and its prolonged contact in quantity with the germs being necessary, while the presence of lifeless organic matter retards or prevents the action of ozone on the living matter.*

Various diseases have been attributed to the increase of ozone in the atmosphere, especially pneumonia and influenza. It is unquestionable that ozone, if respired in appreciable quantity, will excite catarrhal inflammation of the respiratory tract, and that at times its presence in the atmosphere, in notable quantities, is coincident with an epidemic of pulmonary inflammation or with *la grippe*. On the other hand, both of these diseases have been found to be epidemic at times when the ozone of the atmosphere was at a minimum. Diminution of atmospheric ozone has been found to be coincident with epidemics of cholera. This loss of ozone has by some been placed among the causative factors of the epidemic, and by others referred to the increased destruction of ozone by the germs.

Physiological Effects.—The evidence as to the action of ozone upon man and animals is confused and contradictory.† Albumin is rendered incoagulable by acids or boiling after exposure to ozone. Blood out of the body becomes dark, then black, when ozone is passed through it, finally becoming a clear fluid without albumin, a gas not analyzed being given off. Hæmoglobin, like vegetable protoplasm, if brought in contact with ether or terebinthinate oils which have absorbed ozone, will at once cause the latter to give up their ozone. It has also been demonstrated that red blood-cells (or hæmoglobin) can transform the oxygen of the air into ozone by contact, even after they have become saturated with carbon monoxide, which prevents them from absorbing oxygen, the action being comparable to that of the platinum sponge. It has been supposed that the blood transforms into ozone the oxygen which it absorbs, and that the same effect is produced within the blood by tissue oxidation without elevation of bodily heat. Binz, however, by agitating ozone with a solution of albumin and guaiac, with the result that the guaiac was not discoloured, while the albumin was transformed, proved that free ozone could not exist in the blood serum, though the oxygen of oxyhæmoglobin might be yielded up as ozone under some circumstances. The quantity of ozone ordinarily contained in the air is about 1 part in 450,000 by weight, 1 in 700,000 by volume, at about 20 metres above the earth. This quantity, absorbed during respiration, plays the part of a useful stimulant; and to the absence of ozone from the atmosphere has been attributed the torpor and malaise which occur, especially in nervous women, at certain times—particularly in hot, moist weather and before the approach of thunderstorms. The fact that these symptoms frequently disappear after the storm is attributed to the generation of atmospheric ozone by the electric discharges. In large quantities, however, ozone is irritating to the air-passages and destructive to the blood. Birds, which live in the atmospheric regions ordinarily richest in ozone, are the least affected by its toxic action; however, in sufficient concentration (1 in 2,000) it may prove toxic even to birds, causing not only violent pulmonary inflammation, with catarrhal discharges from the mucous membranes in general, as in the case of any other irritating gas, but coagulation of the blood, proving almost immediately fatal. As the passage of ozone through coagulated blood outside of the body restores its fluidity, the coagulation of the blood which follows ozone poisoning has been attributed not to a direct fibrinogenetic influence, but to a destructive influence upon the lung epithelium and even the red cells, interfering with the discharge of carbon dioxide, which therefore accumulates in the organism, and may give rise to all the toxic symptoms. There is depression of the heart and nervous system, due partially to the destructive action of ozone upon the albumin of their tissues, partially to carbon dioxide poisoning, and partially to reflex irritation from the air-passages. In moderate doses by inhalation or by internal use in water or in oil, ozone acts as a local *antiseptic* and under some circumstances as a *stimulant* to metabolic processes, and hence to nutrition in general. A regenerative influence upon the red blood-cells has been attributed to it.

* Ohlmüller. Ueber die Einwirkung des Ozons auf Bakterien. *Arbeiten aus dem kaiserlichen Gesundheitsamte*, viii, 1, Berlin, 1892.

† For extensive bibliography, see Morton, *loc. cit.*

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Therapeutics.—In therapeutic applications, ozone has thus far been demonstrated to have but a limited field of usefulness. Its bactericidal properties are not available in treatment, though its deodorizing and disinfectant powers are useful in preventive medicine. Thus, it should be evolved in quantities in public halls after the presence of crowds, and in small quantities during their occupany. In *croup*, *diphtheria*, *whooping-cough*, *scarlet fever*, *small-pox*, *cholera*, and similar infections, if the sick-room can be charged with ozone in moderate quantity the patients will do better and contagion will be minimized. This is the probable usefulness of the evolution of vapours of turpentine, eucalyptus, and the like. To disinfect the sick-room after contagious diseases, ozone evolved in the largest possible quantity is more efficacious than sulphurous fumigations or other ordinary means. The presence of moisture retards the conversion of oxygen into ozone, but assists the process of disinfection after the ozone has been produced. By direct inhalation, ozone, largely diluted, may be employed with caution. Statements as to doses are quite discrepant in form and substance. French observers speak of $\frac{1}{10}$ milligramme of ozone to the litre of air. Morton recommends 45 to 70 milligrammes of ozone a minute in nasal cases, and but 1 milligramme a minute in chronic bronchitis. Ransome, however, states that his tuberculous patients inhaled for ten or fifteen minutes oxygen of which 9 per cent. had been electrified into ozone. Yet a mixture containing 10 parts of ozone in one hundred has proved fatal to large animals.

By inhalation, ozone has been used by competent observers with apparent good effect in *diphtheria*,* in *cholera*, in *chronic nasal catarrh*, *bronchitis*, *asthma*, and *emphysema*, in *gout* and *diabetes*, in *pernicious anæmia*, and other diseases of the blood. In *ozæna* it may prove of great benefit not only as a deodorizer, but as a stimulant to the nasal mucous membrane, increasing watery secretion and facilitating the reproduction of healthy epithelium. Caillé has thought ozone inhalations beneficial in early *pulmonary tuberculosis*, while Ransome (*Med. Chronicle*, viii, 1888, p. 37; x, 1889, p. 97) observed great amelioration in advanced cases of pulmonary phthisis, especially improved appetite and sleeping power, and consequent gain in weight.

Mr. J. C. Dittrich has recently introduced preparations of ozone dissolved in water (with the addition of 2·5 per cent. of sodium hypophosphite) in various vegetable and ethereal oils and in cod-liver oil. These preparations, unfortunately, have proprietary names attached. Doubtless they will be found useful as gastric and intestinal antiseptics, as stimulants to the circulation, respiration, and digestion, and if the ozone escapes destruction in the stomach, as a means of increasing oxidization in *asthma*, in *gout*, in *diabetes*, and other affections.

[The results of the examination of twenty-two cases of *whooping-cough* treated exclusively with inhalations of ozone have convinced Labbé and Oudin (*Progr. méd.*, July 20, 1895) that the use of ozone produces an immediate amelioration. The spasms of coughing are rapidly modified, not only in frequency, but also in intensity and duration. The respiratory troubles, the cyanosis, and the vomiting almost entirely disappear. The general condition, says M. Labbé, naturally feels this favourable modification; the children recover their spirits, their appetite, and their former healthy appearance. None of M. Labbé's patients were attacked with the broncho-pulmonary complications which are so often observed in this disease. The authors think that in whooping-cough ozone seems to have a special antiseptic action.]

It is quite possible that some of the good effects observed in cases of *chronic malnutrition* of various kinds treated with Franklinic electricity are to be attributed to the ozone developed during the application. The whole subject is still in too much uncertainty to warrant positive statements. It should, however, receive greater attention from clinicians.

SOLOMON SOLIS-COHEN.

* *Vide* Caillé, *Archives of Pædiatrics*, Aug., 1892.

PALMETTO WINE.—According to Dr. Ira W. Porter, of Sanford, Florida (*South. Med. Record*, Aug., 1895), the raw palmetto of the Southern States seems to have a medicinal action on mucous surfaces, and has been used with good results in *bronchitis*, *laryngitis*, *follicular pharyngitis*, *amygdalitis*, and *gonorrhœa*, also to promote the growth of the mammæ and to act as a *tonic* and *fattening agent*. Palmetto wine seems to be a wine made from the juice of Florida oranges imbued with palmetto in some manner that Dr. Porter does not describe. He states that he has prescribed it with success in a case of *nervous impotence*. The dose is not mentioned.

PAMBOTANO. — This is the Mexican shrub *Anneslea grandiflora*. Bocquillon has isolated a glucoside from it. Its active principles are said to be soluble in water and in alcohol. Morales and Labato have found it an efficient remedy in *malarial diseases*. Crespin, of Algiers (*Bull. gén. de thérap.*, Aug. 15, 1895), reports that he has found it effective in many cases in which other remedies, including quinine, had failed, especially of the quotidian and simple continued forms, also those of chronic malarial poisoning; but in malarial neuralgia and in bilious and pernicious cases it appears to exert no decided remedial action. Pambotano is said to be an *appetizer* and *stomachic tonic* of the first rank. Valude, who reports that he has used it with success in various non-malarial febrile affections, such as *typhoid fever*, *influenza*, and the *fever of tuberculosis*, recommends the administration of a decoction of about 17 drachms of the root-bark as a single dose. Pambotano is said to be perfectly harmless.

PANCREATIC EMULSION. — More than thirty years ago Dr. Horace Dobell, of London (*On Tuberculosis; its Nature, Cause, and Treatment. With Notes on Pancreatic Juice*, 2d ed., London, 1866), suggested the hypothesis that *tuberculosis* was due to defective action of the pancreas. A sudden, almost complete or total suspension of normal pancreatic secretion accounted, to his mind, for acute tuberculosis; a less complete suspension or perversion of the function of the pancreas led to chronic tuberculosis; and intermittent pancreatic derangement of either sort was at the bottom of recurrent tuberculosis. Acting on this theory, odd as it now seems, Dr. Dobell set about treating consumptives with various preparations of the pancreatic secretion of the pig, and finally settled on an emulsion of beef fat and pancreatic juice. This pancreatic emulsion, in the form in which it was at last put upon the market, resembled lard in appearance. Although repulsive to some patients, it was readily tolerated by some others who could not take cod-liver oil. While we can not look upon it as in any sense a cure for consumption, it is undoubtedly a nutrient of great value, especially suited to persons whose power of digesting fat is weak. About an ounce of the emulsion, thoroughly mixed with a pint of milk, may be given daily.

PANCREATIC EXTRACT.—See PANCREATIN and under ANIMAL EXTRACTS AND JUICES, page 80.

PANCREATIN, *pancreatinum* (U. S. Ph.), *extract of pancreas, pancreatic extract*, is defined in the *Pharmacopœia* as a mixture of the enzymes existing in the pancreas of warm-blooded animals. It is usually obtained from the fresh pancreas of the hog. It sometimes occurs in yellowish, brittle scales, but more commonly as a yellowish-white, amorphous powder without odour or having a peculiar faint odour and a faint meat-like taste. It is almost completely soluble in water, but insoluble in alcohol. The ferments found in pancreatin are those of the pancreatic juice, and are at least three in number: *trypsin*, which converts albumins into peptones; *ptyalin*, an emulsive ferment; and *amylopsin*, which converts starch into dextrin and sugar. It also has faint milk-curdling properties, due probably to a ferment. The pancreatic ferment acts in alkaline or neutral solution. An acid destroys its activity. Its chief digestive action is exercised upon the proteids and starches. It converts the former into peptones and certain minor products through the agency of the trypsin. The pancreatic juice is the chief agent for the digestion of starch, which it converts into glucose. Pancreatic digestion of proteids differs materially from peptic digestion. The pancreatic ferment, in an alkaline medium, acts chiefly on fibrin, which it corrodes away, forming leucine, tyrosine, hemipeptone, and several other less important products. The peptic ferment, in an acid medium, acts best on albumin, which swells before it is dissolved. The products of this digestion are peptones, albumose, and syntonin. Five grains of good commercial extract of pancreas will digest a pint of milk rendered alkaline by bicarbonate of sodium. Pancreatic extract acts upon starch paste with great rapidity, 5 grains being sufficient to almost immediately convert 100 grains of starch into sugar.

Pancreatin is chiefly used in medicine for the purpose of predigesting food. This subject is fully considered in the article on ALIMENTATION, to which the reader is referred. It is not infrequently given in capsules or tablets, in doses of from 3 to 5 grains. The utility of the preparation thus employed is doubtful, as its activity is probably at once destroyed by the acid secretion of the stomach. It is best administered from two to four hours after meals. For the purpose of making so-called peptonized foods it is an agent of the utmost value in the nourishment of patients seriously ill or suffering from impaired digestion. The pancreatic ferment, trypsin, is used for a variety of purposes for which the extract is not employed, and is considered in its proper place.

[Cf. *Pancreatic extract*, under ANIMAL EXTRACTS AND JUICES, vol. i, page 80.]

FLOYD M. CRANDALL.

PANSY.—See VIOLA TRICOLOR.

PAPAIN, PAPAIVA.—See under PAPAW.

PAPAVER.—See POPPY.

PAPAW, *papain, papaiva, papayotin*, or *papoid*, is a ferment prepared from the juice of the papaw tree of South America and the West Indies. It is obtained by incising the half-ripe fruit of *Carica papaya*. A white, milky juice exudes, which on drying forms a white amorphous or slightly granular powder which has a slightly astringent but not acrid taste. This powder contains a ferment which has not as yet been obtained in a state of absolute purity. It is freely soluble in water and in glycerin, but is precipitated by alcohol and the tinctures, acetate of lead, tannic acid, and nitric acid.

Papain is a proteolytic agent of decided power. It resembles in its action trypsin more closely than either of the other natural digestive ferments, its final product being leucine. Like trypsin, it acts in an alkaline or neutral medium, but unlike trypsin, it acts also in a slightly acid medium. Its action is arrested but not wholly destroyed by hydrochloric acid. It has been said that it is not a true ferment, but rather a solvent. Sharpe affirms that its action is that of hydration. This view is not generally held by more recent observers. It is maintained by Woodbury that it has a slight effect in converting starch into maltose. This action has not been observed by others. Its action is not interfered with by the ordinary antiseptics.

Although its digestive power is great, its action has probably been somewhat overestimated. A feature of great importance is the fact that it is active in both acid and alkaline media, and may be administered in hydrochloric acid or in an alkaline mixture. It is

employed in the various conditions in which pepsin is indicated—namely, in forms of *dyspepsia* resulting from deficiency of gastric juice. It is especially efficient in those forms of *gastric catarrh* which are marked by an excessive secretion of mucus, a condition especially common in chronic alcoholism. In such conditions it should be given before meals, as it seems to have the power to a certain degree of removing the unhealthy mucus. Another dose may be given after the meal. As is the case with pepsin, its good effects are frequently transient, and no curative results follow its use. In these conditions the dose varies from 1 to 5 grains; 2 or 3 grains are frequently as efficacious as larger amounts. It may be administered in capsules, powder, solution, or compressed tablets. The last-mentioned form is the one most commonly employed. It is very unstable, and in solution with plain water quickly decomposes. If the solution is rendered slightly acid or alkaline it does not decompose so readily. A solution containing glycerin keeps indefinitely. As the ferment is more active in concentrated solution, it should not be given largely diluted, and but small quantities of water should be taken by the patient with his meals. In *dilatation of the stomach*, where a dry diet is used, papain acts especially well. The treatment of digestive disorders by digestive ferments is, as a rule, unsatisfactory. The applications of papain would seem to be more extensive, however, than those of pepsin or pancreatin, as it can be combined with a much larger number of drugs. Its use may therefore be added for its temporary effect to other treatment designed to cure the diseased condition.

Papain has the undoubted power of destroying intestinal parasites. It is effectually used for the removal of *roundworms* and *tapeworms*. In large doses it seems to have a toxic effect on the worm. In smaller and repeated doses it seems to be efficacious through its power of digesting albuminous substances. It is used most successfully in doses of from 2 to 3 drachms, which should be given in the morning, the patient having been prepared with the same care as should be exercised when other tæniafuges are employed. It is wise to combine it with bicarbonate of sodium, to neutralize somewhat the acids of the stomach so that the drug may act most effectually.

The use of papain for dissolving the membrane of *diphtheria* has been vigorously advocated by Jacobi. He applies to the membrane a solution of papain in glycerin, one part to four. The solvent power of the solution thus applied is undoubted, and in many cases its good effects are equally clear. It has not, on the whole, however, proved so efficacious as to have maintained its position as an efficient and satisfactory remedy in diphtheria. At the present time it is but little used. It is employed in surgery in the same manner as trypsin. As a dusting powder, it has been used with bicarbonate of sodium in the proportion of five parts to one, or with equal parts of boric acid. As a paste for *unhealthy sores* or *sloughing tissue*, a drachm of papain may be thoroughly mixed with 2 drachms of glycerin or with boroglyceride. For injection into cavities or sinuses, a drachm may be dissolved in 2 drachms of glycerin and 6 drachms of water.

[According to Dr. Cerna, papoid has been recommended for dissolving *accumulations of cerumen* in the ear; it has been used with decided success in the treatment of *fissure of the tongue* after the failure of other applications, such as iodoform, chromic acid, and nitrate of silver; and it has been employed advantageously in the treatment of *syphilitic ulcerations of the tongue.*

Dr. J. F. Barbour (*Notes on New Remedies*, Jan., 1894; *Am. Jour. of the Med. Sci.*, Apr., 1894) reports a case of *ulcer of the stomach* in which papain relieved the symptoms, including that of pain, which did not return when the employment of the remedy was discontinued, after it had been given for three weeks.

Mittra (*Med. Reporter*, Jan., 1894; *N. Y. Med. Jour.*, June 9, 1894) uses papaw juice internally, usually in doses of 10 drops. He thinks it a *gastric sedative* of great power, as is seen in the magical relief obtained from it in certain forms of *gastric irritation* and *vomiting*. He regards it as a valuable *antacid* also, more trustworthy than sodium bicarbonate. Locally, it may be used as a solvent of small *polypous*, *warty*, and other *growths*.]

FLOYD M. CRANDALL.

PARA-ACETPHENETIDINE. — See PHENACETINE.

PARABROMACETANILIDE.—See ANTISEPSIN.

PARACHLOROPHENOL, PARACHLORPHENOL. — See under CHLOROPHENOLS.

PARACOTOIN, PARACOTOINIC ACID.—See under COTO BARK.

PARACRESALOL, PARACRESOL SALICYLATE, $C_6H_4.OH,COO,C_6H_4.CH_3$, is a crystalline compound resembling salol in its medicinal virtues, and said to be particularly efficient as an *intestinal antiseptic*. It is insoluble in water. From 3 to 30 grains may be given in the course of twenty-four hours, preferably in wafers.

PARAFFIN.—The name paraffin was applied, in 1830, by Reichenbach to a substance which he isolated from the products of the dry distillation of wood, as well as from animal tar and coal-tar. This substance proved to be so indifferent toward energetic chemical reagents that he based its new name on this property (*parum* = but slightly, *affinis* = related; combinable). During the next decade various attempts were made to produce this substance on a large scale, for Reichenbach had already pointed out its prospective usefulness as an illuminating agent; but it was not until 1850 that marketable amounts of it were produced in England. Since then the production of paraffin has become very extensive in various parts of the world, most of the material being used for candles.

At present paraffin is obtained chiefly during the distillation of brown coal (lignite), turf,

petroleum, or ozokerite. After the lighter or lower-boiling fractions, so far as they are present, have been driven over, the distillate becomes heavier and more viscid, until the temperature of about 265° C. is reached, when the so-called paraffin oil begins to pass over. As the temperature increases this carries over a substance practically identical with it in chemical composition but capable of being separated from it in a solid condition by cooling. The crude distillate is treated with strong sulphuric acid, which chars the accompanying resinous matters, the sulphuric acid is removed, and the residue, after being washed, is again distilled. The first fraction is liquid, and is added to the liquid paraffin oils; the remainder of the distillate constitutes the paraffin, which is set aside in suitable vessels to crystallize. The crude solidified paraffin is next subjected to centrifugal action to remove from it any liquid paraffin that may still adhere to it, and is then treated with the lightest benzin to dissolve out the remainder of the adhering impurities. As the benzin dissolves also a small portion of the paraffin, it is subsequently subjected to special processes to recover the latter. Finally, the remaining paraffin is melted and steamed to remove the odour of benzin, and then pressed into cakes.

Commercial paraffin is colourless when liquid, white and translucent when solid; the softer kinds are white and opaque. It becomes readily plastic when warmed. When heated to 160° C. it begins to volatilize. At about 350° C. it begins to boil with partial decomposition.

Paraffin is often used as a substitute for wax: in this case the high-melting varieties should be chosen. When it is combined with ordinary fats it is very apt to separate during the process of cooling. It is, therefore, not a good constituent of ointments.

The use of paraffin as a coating for pills, or as an ingredient in pill-masses for potassium permanganate, silver nitrate, etc., which has been repeatedly advocated, is not to be recommended, as the paraffin is absolutely insoluble in the juices of the digestive organs.

[Hard paraffin, *paraffinum durum* (Br. Ph.), *paraffinum solidum* (Ger. Ph.), is paraffin wax. The Br. Ph. prescribes its use in various ointments. Soft paraffin, *paraffinum molle* (Br. Ph.), is vaseline, the *petrolatum* of the U. S. Ph. Liquid paraffin, *paraffinum liquidum* (Ger. Ph.), is liquid vaseline.]—CHARLES RICE.

PARAFORM, or *triformol*, a polymer of formaldehyde, is a white crystalline substance almost insoluble in water. The name paraform seems to have been given to it by Dr. Hans Aronson, who introduced it as an *antiseptic* at a meeting of the Berlin *Verein für innere Medicin* held on March 5, 1894 (*Berl. klin. Woch.*, Sept. 24, 1894). It is chiefly as an *internal antiseptic* that Aronson advocates the use of this substance. His experiments show that in germicidal power it far exceeds salol, benzonaphthol, iodoform, aristol, bismuth-tribromphenol, and naphthalin, and that it somewhat excels β-naphthol; this extraordinary efficiency he attributes to its giving off vapours of formaldehyde, for it is not necessary to place it in actual contact with the germs to secure their inactivity. Paraform appears to be almost if not quite free from poisonous properties; Aronson himself took 75 grains of it in the course of twenty-four hours. Aronson likens the physiological action of paraform to that of calomel; in various animals and in man, large doses (in man one or two doses of 30 grains) give rise to diarrhœa. Aronson says that it destroys not only bacteria, but also their poisonous products; guinea-pigs he has found able to take with impunity large quantities of a highly poisonous diphtheria culture in bouillon, provided paraform is added to it in the proportion of 1 to 500. At the time of his report he had used it with good results in twenty cases of *cholera infantum*, in the initial stage, in doses of from ¼ of a grain to 1½ grain every two hours. He recommended that it be tested also in the incipient stage of *typhoid fever* and *cholera* in adults. The dose for adults is from 5 to 15 grains, three times a day, preferably in capsules. When paraform is given subcutaneously, formaldehyde passes into the urine; when it is given by the mouth, however, this does not occur. Paraform, applied pure to raw surfaces, is highly irritant, and for use on *wounds* and *ulcers*, therefore, it should be diluted with dermatol or talc. Ointments are not suitable for diluting paraform, according to Blaschko, for the fat contained in them interferes with the liberation of fumes from the drug.

PARALDEHYDE, *paraldehydum* (U. S. Ph., Ger. Ph.), $C_6H_{12}O_3$, is a polymeric modification of aldehyde. As found in the shops, above a temperature of from 40° to 53° F., it is a colourless liquid, having a peculiar, unpleasant, ethereal odour and a pungent, disagreeable taste. It is very soluble in alcohol, and dissolves in about 8 parts of cool water, but less readily in hot water. It has been principally used as a *hypnotic*, but in appropriate doses it is also *sedative*, *depressant*, *antispasmodic*, and *diuretic*. Its administration in large doses is followed not only by an increased flow of the watery constituents of the urine, but also by a marked increase in the elimination of urea. In producing sleep paraldehyde acts very much like chloral, with the important difference that it has less depressing effect upon the heart. It is supposed to produce sleep by its action on the brain. When given in poisonous doses to the lower animals, it lessens reflex action, paralyzes the spinal cord, and arrests respiration before the heart ceases to beat. In sufficiently large doses it depresses or paralyzes the vaso-motor centres so that dilatation of the arterioles takes place. Decreased arterial pressure, slight diaphoresis, and increased peristalsis result from the full effects of this agent.

Poisoning from Paraldehyde.—Thomas MacKenzie, of Douglas, England (*Brit. Med. Jour.*, Dec. 12, 1891), records an interesting and instructive case of poisoning from paralde-

hyde in a woman who took by mistake 3½ oz. The drug was taken at 11 P. M., and the patient was not found until the next morning, when she was in a deep stupor and limp, like a person deeply under the influence of chloroform, with a strong odour of paraldehyde on the breath, face slightly flushed, pupils moderately contracted and quite insensitive to light, pulse 120, respirations 40. A complete recovery took place. Notwithstanding every means was used to arouse her, it was forty-one hours from the time the drug was taken before she was able to understand and reply to simple questions. This remarkable case seems to indicate the harmlessness of paraldehyde when employed in therapeutic doses, provided there is no contra-indication to its use.

The Paraldehyde Habit.—It was thought that the very disagreeable taste and odour of paraldehyde would be sufficient to prevent a craving or habit being contracted for it, but experience has taught us our mistake. Several cases of the paraldehyde habit are on record, and the results, mental and physical, have usually been disastrous where the habit has been continued a great length of time. Dr. Frederick Peterson, of New York (*Med. Record*, Dec. 10, 1892), records an apparent exception. A woman took ounce doses nightly for months and grew fat, without apparently suffering any bad effects. It is probable that if such cases are watched evil effects will manifest themselves, as fatty degeneration of the liver has been experimentally produced in animals by the use of large quantities of paraldehyde. One of the most remarkable cases on record of the paraldehyde habit is one recently published by Mr. Frank Ashby Elkins (*Quart. Jour. of Inebriety*, Oct., 1894, p. 333), in which the patient had been accustomed to take 16 oz. of the drug a week. The patient rapidly became emaciated, and presented great cardiac and general muscular weakness and subsequently delusions of persecution, with mental failure. A complete recovery took place in three months under restraint and appropriate treatment. Symptoms very similar to those of chronic alcoholism are likely to follow large doses of paraldehyde continuously employed for a considerable length of time. Krafft-Ebing has observed epileptoid convulsions to follow the prolonged and extravagant use of this drug.

Therapy.—That paraldehyde in a large proportion of cases is an efficient hypnotic no one who has given it a fair trial doubts. In these days, when the agents by which sleep may be produced are so numerous, the physician often finds himself puzzled in trying to decide which one to select for an individual case or a particular class of cases. The large dose of paraldehyde, from 60 to 120 minims, required to produce sleep, and its repulsive odour and disagreeable taste, should decide against this drug when another equally efficient and harmless and more agreeable to the patient can be obtained. The drug under consideration seems to be a respiratory depressant, and I feel inclined to indorse Dr. W. H. Flint's conclusions: "It is contra-indicated in cases of cyanosis with depression of the respiratory centres, as in the advanced stages of emphysema and cardiac dilatation" (*Therap. Gaz.*, Jan. 15, 1890). The same writer believes that paraldehyde is contra-indicated in most cases of insomnia attended with much physical or mental depression. Krafft-Ebing has found it a most remarkable hypnotic in the *sleeplessness of insanity*. Dr. Leech, of England, regards it as the best hypnotic for continuous use, and Dr. Clouston favours it as one of the best when the insomnia is marked and intractable. My rule in the use of hypnotics is never to employ any one continuously for a prolonged period, but to alternate them from time to time and sometimes to give two or more in combination, never letting the patient know what drug he is taking. The three hypnotics on which I mainly rely are sulphonal, trional, and chloralamide. In some cases I have found paraldehyde to act better than any of the three just mentioned. I have found headache, vertigo, nausea, and sometimes one or two watery evacuations from the bowels to follow full doses of paraldehyde. The cases of insomnia in which this hypnotic seems to have the best effect are those attended with mental and nervous excitement. In the early stage of *delirium tremens* it sometimes affords prolonged and refreshing sleep. I have never used it to overcome the insomnia of chronic alcoholics.

[Dr. B. D. Evans, of the Morris Plains Hospital, Morristown, N. J., an institution for the insane (quoted in *Ephemeris of Mat. Med.*, etc., Jan., 1896), says that, although this drug is established as a valuable and reliable hypnotic, however, there are two serious objections to it; first, that it gives to patients when swallowing it the sensation of smothering or strangling, and second, its slow elimination through the lungs, leaving some patients drowsy and all patients with its strong odour for six or eight hours after its sleep-producing effects have passed away, but withal it may be relied upon to give in a case of almost any form of *insomnia* from four to six hours of refreshing sleep, when administered in doses of from 1 to 2 fl. drachms in equal parts of whisky and syrup of orange. In the *sleeplessness of chronic alcoholism, alcoholic mania, delirium tremens*, and "chronic disturbers," says Dr. Evans, this drug has no superior as a hypnotic. In many of the acute forms of *insanity* it acts very gratefully, but occasionally it fails. It does not disturb the appetite, and does not depress the heart's action.]

Dr. A. B. Cook has found paraldehyde serviceable in *asthma, puerperal convulsions*, and *cough* (*Ann. of the Univ. Med. Sci.*, v, A–115, 1889). In twelve cases of spasmodic asthma, some of which had been submitted to the usual forms of treatment, Dr. William Mackie succeeded in causing the disappearance of the spasm in a short time by the administration of paraldehyde in doses of ½ a drachm, repeated every half hour until the effect was produced. The author never was obliged to give more than three doses; often one sufficed (*ibid.*, v, A–66, 1894).

[In the *British Medical Journal* for March

21, 1896, Mr. Frederick P. Hearder states that he has used paraldehyde, with good effect, in about thirty cases of asthma, including ordinary spasmodic asthma, asthma with epilepsy, with heart disease, with renal disease, and with chronic bronchitis, and in two cases of asthma with pneumonia. In the majority of the cases, he says, relief was rapid and complete, and in the remainder the distress was lessened. The dose employed was from 45 to 60 minims, and one dose was usually sufficient; a few patients, however, needed a further dose of from 30 to 45 minims an hour or so later. Using these doses, Mr. Hearder has never observed any untoward action of the drug, but, on the contrary, the breathing has gradually become easy and normal, the pulse been steadied and strengthened, and the patient fallen into a comfortable sleep. A point in dispensing, says Mr. Hearder, is that the addition of a few drops of alcohol renders paraldehyde perfectly miscible with water; any flavouring tincture can be used for this purpose.]

Humphrey has found paraldehyde an excellent remedy in *Cheyne-Stokes respiration* associated with *broncho-pneumonia*. Ignatieff and Tchervinsky have obtained good effects from the use of paraldehyde in the treatment of *tetanus*. About 150 minims were given daily, either by the mouth or by the rectum (*Year Book of Treatment*, 1892, p. 112).

Dose and Administration.—The dose to produce sleep should be from ½ to 1½ drachm. It is better, as a rule, to begin with the smaller dose and repeat it every hour or two until sleep results. Small doses rarely have much effect in overcoming obstinate insomnia. I have found the elixir of Curaçoa, to which some alcohol may be added with advantage, an excellent menstruum. (See also under Hypnotics, vol. i, p. 509).

Jeremiah T. Eskridge.

PARASITICIDES.—See Antiparasitics and Anthelminthics.

PARATALOID.—See Tuberculin.

PAREGORIC, *tinctura opii camphorata* (U. S. Ph.), camphorated tincture of opium, is virtually an elixir containing opium, benzoic acid, oil of ânise, camphor, and glycerin in diluted alcohol. It contains somewhat less than a grain of opium in each half ounce. It is therefore the weakest official preparation of opium, and is especially adapted to use where a very small dose of that drug is desired. It is largely used where opium is indicated in diseases of children, as the dose can be very readily graduated. The camphor renders it especially serviceable in *diarrhœa*. In this disease it is used in enormous quantities, as it is one of the commonest ingredients of diarrhœa mixtures. It is a serious error, however, to add it to a mixture which is to be given at short intervals. The younger the patient the more serious does this error become. If it is thus given in sufficient quantities to produce appreciable results, it is difficult to avoid narcotism after a few doses. It is far safer and the results are more satisfactory to administer it entirely alone at sufficient intervals to allow the effect of one dose to subside before another is given. The diarrhœa mixture can thus be given as frequently as it is indicated by the symptoms. Paregoric is also a frequent ingredient of *cough mixtures*. One of its chief effects when thus used is to destroy the appetite and disturb the digestion. The same rule as to frequency of administration applies here as in diarrhœa. The dose must be graduated according to the dose of opium desired. This varies so greatly that no positive rules can be given. As a rule, a minim for each month of a baby's age may be given as an initial dose. It should be remembered that paregoric, being an alcoholic solution, drops at least 2 drops to the minim. Twice as many drops, therefore, should be given as minims. Paregoric is a preparation rarely used by persons addicted to the opium habit. In the few cases which have come under the writer's observation in which it was used the results have been especially disastrous. The raw alcohol and perhaps the camphor have seemed to increase materially the bad effects of the opium. (See Opium.)—Floyd M. Crandall.

PAREIRA (U. S. Ph.), *pareiræ radix* (Br. Ph.), is the root of *Chondodendron tomentosum*, a menispermaceous climbing plant indigenous to tropical America. It is chiefly used in the treatment of *chronic cystitis*. The dose of the decoction, *decoctum pareiræ* (Br. Ph.), is from 1 to 2 fl. oz.; that of the extract, *extractum pareiræ* (Br. Ph.), from 10 to 30 grains; and that of the fluid extract, or liquid extract, *extractum pareiræ fluidum* (U. S. Ph.), *extractum pareiræ liquidum* (Br. Ph.), from ½ to 1 fl. drachm.

PARILLA, YELLOW.—See Menispermum.

PARIS GREEN.—See under Arsenic.

PARODYNE.—See Antipyrine.

PARSLEY.—See Petroselinum and Apiol.

PARTHENICINE.—Dr. Ulrici, a Cuban physician (*Brit. Med. Jour.*, June 16, 1888; *N. Y. Med. Jour.*, Oct. 13, 1888), has experimented with this alkaloid, obtained from the leaves and flowers of *Parthenium Hysterophorus*, a West Indian plant. Parthenicine is described as crystalline, intensely bitter, and poisonous to animals. It is said to be *antipyretic*, *antiperiodic*, and *analgetic*. It has been given in daily amounts of 15 grains. Possibly this alkaloid is identical with *parthenine*, obtained from the same plant.

PARTHENINE.—This alkaloid, possibly the same as *parthenicine*, is obtained from *Parthenium Hysterophorus*. It has been used as a remedy for *malarial fever* and *neuralgia*, in doses of from 7 to 10 grains.

PASTES.—These are plastic, cohesive, and adhesive mixtures, for internal or external use, according to the nature of the ingredients, and intended to be only slowly dissolved, or to exert a continuous slow action.

The "pastes" for internal use have practically ceased to be an object of the apothecary's art, belonging rather to the sphere of the confectioner. And yet many medicines might

with great propriety be incorporated with such "pastes"—for instance, with those of marsh mallow, jujube, etc.—and administered in this manner.

Pastes for external use are mostly intended to act as escharotics. Those more or less in use at the present time are the following:

Canquoin's Paste.—Rub 300 grains of fused zinc chloride to a powder, and make a paste with 1 fl. drachm of alcohol. Then add 420 grains of flour, using strong pressure with the pestle. When the paste is homogeneous, roll it into strips about ¼ of an inch thick, allow them to stand exposed for a few hours, then transfer them to well-closed bottles.

Latour's Paste.—Dissolve 300 grains of fused zinc chloride and 600 grains of zinc nitrate in 1 fl. oz. of water, allow the solution to cool, and incorporate 600 grains of flour. Roll the mass into strips about ¼ of an inch thick, and keep them in well-closed bottles.

Smith's Paste.—Deprive crystallized zinc sulphate of its water by the heat of a water-bath, then transfer the powder to a crucible and keep it at a low red heat for a short time. Transfer the powder while hot to small glass-stoppered phials, which should be made absolutely air-tight with wax or paraffin. When the paste is required, open one of the phials and mix the contents by means of a glass rod with enough concentrated sulphuric acid to produce a plastic paste. (Recommended and used as an escharotic in *cancer* by Dr. Stephen Smith.)

Similar pastes are those known under the names of Michel, Rust, Velpeau, and Ricord, in which the anhydrous zinc sulphate is replaced by powdered asbestos, saffron, licorice root, and charcoal, respectively.

Vienna Paste.—This is prepared from the official *potassa cum calce*, consisting of equal parts by weight of caustic potassa and quicklime, rubbed together in a warm mortar so as to form a fine powder, which must be kept in well-stoppered bottles. For use it is made into a paste with alcohol.

Of non-escharotic pastes, the following deserve mention:

Lassar's Naphthol Paste.

Beta-naphthol	10	parts;
Precipitated sulphur	50	"
Soft soap, each	20	"
Vaseline, each	20	"

Lassar's Resorcin Paste.

(1. Strong.)

Resorcin, Zinc oxide, Starch, each	20	parts;
Liquid paraffin	40	"

(2. Weak.)

Resorcin	10	parts;
Zinc oxide, Starch, each	25	"
Liquid paraffin	40	"

Unna's Lead Paste.

Litharge, Glycerin, each	30	parts;
Rice starch	10	"
Vinegar	60	"

Unna's Zinc Paste.

Zinc oxide, Starch, each	25	parts;
Vaseline	50	"

CHARLES RICE.

PASTILLES, PASTILS, are small cones or tapers prepared from an aromatic mass which, when dry, can be made to burn slowly at a glow, and thereby cause the odorous substances to be diffused through the room. Their preparation on the small scale is best carried on in this way: The ingredients, well mixed to a tenacious but pliable mass, are rolled out on a board or on the pill-machine into uniform cylinders of a diameter of about ⅛ or ¼ of an inch, which are cut into pieces of equal length and shaped into small cones. They are then dried at a gentle heat. The following formula is recommended, but this may be modified in many ways to produce different odours:

Red Pastils.—Moisten 725 parts of red saunders, in No. 50 powder, with a solution of 75 parts of potassium nitrate in 1,000 of water, and dry the mixture. The object of this is to impregnate the powdered wood uniformly with the saltpetre. Prepare a mixture of 50 parts of tincture of benzoin, 20 of balsam of Peru, 40 of balsam of Tolu, 40 of storax, 2 of oil of sandalwood, and ½ part of cumarin, and if necessary add to it just enough alcohol to render it homogeneous and capable of being poured. Having mixed the powdered red saunders with 30 parts of powdered tragacanth, incorporate with it the odorous mixture thoroughly, and finally work into it enough mucilage of tragacanth, containing 2 per cent. of potassium nitrate, to obtain a pliable dough, which is to be rolled out and formed as above directed. Before the pastils are quite dry they may be painted with a thin coating of some liquid metallic bronze, to give them a handsome appearance.

Pastils not only are useful for diffusing a pleasant aroma, but may also be made the medium of impregnating the air with medicinal vapours. Some examples (partly after Dieterich) will show how this may be done:

Carbolic-acid Pastils.—Mix 830 parts of charcoal, in No. 50 powder, with a solution of 50 parts of potassium nitrate in 1,000 parts of water, and dry the mixture. Next mix it with 20 parts of powdered tragacanth, and then incorporate with it thoroughly 100 parts of carbolic acid and 1 part of oil of wintergreen, and finally work into it enough mucilage of tragacanth (containing 2 per cent. of saltpetre) to give the mass the proper consistence.

Cresol Pastils.—These are made like the preceding, except that 100 parts of cresol (cresylic acid) are taken in place of the carbolic acid.

Creosote Pastils.—These may be made with 50 parts of creosote.

Tar Pastils may be made to contain from 50 to 100 parts of tar.

Chloride-of-ammonium Pastils.—Six hundred and fifty parts of powdered charcoal are moistened with a solution of 250 parts of ammonium chloride, 75 of potassium nitrate, 5 of

sugar, and ½ part of cumarin in 700 parts of water, and then dried. The powder is mixed with 20 parts of powdered tragacanth, and the mixture made into a mass with mucilage of tragacanth (containing 2 per cent. of saltpetre). Lastly, 10 drops each of balsam of Peru and oil of rose are incorporated, and the mass is formed in the usual manner. Dieterich recommends giving them a coating of silver-bronze.

Iodide-of-ammonium Pastils. — These are made like the preceding, the quantities of the first three ingredients being 825 parts of charcoal, 100 parts of ammonium iodide, and 50 of potassium nitrate.

Iodine Pastils.—Eight hundred and eighty-five parts of powdered charcoal, 40 of potassium nitrate, 5 of sugar, and 20 of powdered tragacanth are combined as described in the preceding formulæ. To the mixture is added a solution of 50 parts of iodine and $\frac{1}{10}$ part of nerolin (the synthetic perfume) in 200 parts of ether; the whole is spread out and exposed to the air for a few minutes, and then it is formed into a mass with mucilage of tragacanth. When the pastils have been formed they must be dried without heat. To prevent further loss of iodine as far as possible, they should be covered with a coat of benzoin by several times applying a tincture of benzoin of double strength. When they are perfectly dry, they must be kept in glass-stoppered vessels in a cool place.—CHARLES RICE.

PAULLINIA.—See GUARANA.

PEANUTS.—See ARACHIS.

PEAT is a kind of carbonaceous earth found beneath the surface and composed principally of vegetable roots and fibres in various stages of decomposition. It is produced under several different conditions of climate and topography, but usually in swampy or marshy places or where the atmosphere is for a considerable portion of the year foggy. It is abundant in northern Europe, Scotland, Ireland, and India, and in some parts of the United States. The principal vegetables which by their decomposition form peat are the different varieties of moss called *Sphagnum* and—especially in India—wild rice. It is probable that peat is a product of one stage in the formation of coal, and, indeed, it is in some countries extensively used, when dried, as fuel.

Peat is usually of a dark or blackish colour; it is spongy and in its more superficial layers contains much water. Its reaction is acid, due to the presence of humic, phosphoric, and sulphuric acids. When dried, peat is a light, very absorbent material which—because of these properties as well as by a supposed antiseptic quality, due, perhaps, to its acid constituents—has been deemed suitable as a dressing for *wounds*. Like dry earth and charcoal, it causes the disappearance of foul odours and improves the appearance of granulations. When used for these purposes, the peat should be dusted upon the wound quite thick, and should be often renewed. It has been highly recommended in *foul-smelling ulcers* and in *gangrene*. Peat may also be used as an ordinary wet or dry surgical dressing, when it will be found convenient to have it sewed into bags of cheese cloth made in various sizes. It is supposed to have a special virtue as a wet dressing or poultice. It has been the practice since the beginning of the antiseptic era to moisten the wet peat dressing with one or another of the well-known antiseptic lotions, such as bichloride-of-mercury or carbolic-acid solution. The peat then, of course, has little or nothing to commend it over the more usual dressings. Still, in an emergency, such as may exist in time of war where for one reason or another the ordinary gauzes, etc., may be unobtainable, if the country is one where peat abounds it may be found useful.

Another use for it exists in certain parts of Europe and Africa—namely, as an immersion medium or kind of bath for the entire body. The peat for this purpose has such a large admixture of water that it becomes a kind of thin mud or slime. (See BATHS.)

White peat is the name of a very finely powdered silicious earth formed from extinct varieties of diatoms. This is not, properly speaking, a true variety of peat, but is something quite different. It is silicious, not carbonaceous; it will not burn, but may be sterilized by heat. It has in itself no antiseptic qualities. White peat in bulk is used as a filter, and it is also used in the manufacture of dynamite.

ARPAD G. GERSTER.
HOWARD LILIENTHAL.

PECTORALS.—See EXPECTORANTS.

PEDILUVIUM.—The foot-bath (see under BATHS, vol. i, p. 169).

PELLETIERINE, the active alkaloid of pomegranate, is, on account of the small bulk of the dose required, the most elegant *tæniacide* known, but is hardly suited for general use, on account of its relatively high cost. In appropriate doses it appears to be without any marked effect upon the general economy, but in unduly large amounts it may give rise to vertigo, diplopia, and muscular weakness, and in some instances it has been known to cause temporary paralysis of the voluntary muscles. It is never used in its basic state, but either as the sulphate or the tannate, the latter being regarded as the most effective. From ½ to 1 grain may be given in the morning after the preliminary treatment given in the article on ANTHELMINTHICS has been followed out. It is usually followed by no general symptoms except perhaps a slight feeling of giddiness, but may excite nausea and vomiting. As a rule, it may be depended upon to purge, but if it fails to do so within two or three hours a cathartic must be administered. The proprietary preparation known as "Tanret's pelletierine" is very largely used instead of the tannate and appears to be entirely free from objection. Pelletierine and its salts have been employed in the treatment of *paralysis of the third and fourth cranial nerves*, and with reported good results.

The bark and stem of the root of *Punica*

granatum, or pomegranate, *granatum* (U. S. Ph.), *granati radicis cortex* (Br. Ph.), *cortex granati* (Ger. Ph.), may be substituted for pelletierine, of which they are the source, but, on account of the considerable bulk necessary to constitute a proper dose, the crude drug is open to objection and, besides, is rather more apt to cause nausea and vomiting. The powdered drug may be given in doses of ½ oz., but a decoction made by soaking 2 oz. for twenty-four hours in a quart of water and afterward reducing it to one half its bulk by boiling is preferable. The whole amount may be taken at once, but it is more usual to administer it in divided doses at such intervals as may seem appropriate in individual cases.

[There is an official decoction, *decoctum granati radicis* (Br. Ph.), the dose of which is from 2 to 4 fl. oz.].

The rind of the fruit and the flowers also are said to have the same properties as the bark. They may be given in doses of from 20 to 30 grains. The rind is also astringent, and is sometimes used in the treatment of *diarrhœa*. (Cf. ANTHELMINTHICS).—RUSSELL H. NEVINS.

PELLITORY.—See PYRETHRUM.

PENCILS, also called *bougies*, are small cylindrical rods about $\frac{1}{16}$ to ½ of an inch in diameter and from about 2 to 6 inches long, pointed at one end, and weighing from 15 to 30 grains. They are intended to be introduced into cavities requiring this form, such as the urethra, sinuses, etc. They may be formed either by hand or by rolling on a pill-tile or board, or they may be made by pouring the melted mixture into glass tubes previously oiled inside, and then pushing the pencils out by means of a suitable glass rod. They may be made of cacao butter or of gelatin. Those made of cacao butter are apt to be very brittle and to break easily. Those made of gelatin are preferable. For the latter, the following method may be employed: Soak 10 oz. of the best gelatin in water until it has become soft, pour off the excess of water, melt the softened gelatin, add 16 oz. of glycerin, and heat the mixture on a water-bath, constantly stirring, for about an hour. Then incorporate or dissolve in it the medicinal ingredient, being careful to keep the mass well stirred if the remedial agent is insoluble in the mixture, and pour it into suitable glass moulds previously coated on the inside with oil or soap liniment. When the mass has set, push it out by means of a rod and cut the pencil into sections of suitable length. As glass tubes are usually slightly tapering, it is well to remember that the pencils should be pushed out at the wider end.—CHARLES RICE.

PENNYROYAL.—See HEDEOMA.

PENTAL, trimethylethylene, β-isoamylene, C_5H_{10}, an isomer of amylene, is a colourless and very inflammable liquid which boils at 100·4° F., and, though volatile, is not decomposed on exposure to light or air. Its odour is strong and pungent and has been thought to resemble that of mustard. Pental is insoluble in water, but with alcohol, ether, and chloroform it is miscible in all proportions. The physiological action of pental is in particular that of a *general anæsthetic* of rapidly developed but transient effect. From its inhalation there results, usually within two or three minutes, loss of sensibility without absolute loss of consciousness, so that the command to open the mouth or perform some similar action may be complied with. A persistence in the administration of the drug, however, results in narcosis. The unconsciousness produced by pental is brief, unless the administration is continued, its duration seldom exceeding four minutes. The return to consciousness is rapid and is apt to be followed by a brief period of analgesia, during which operative procedures may sometimes be continued. The inhalation of pental is but slightly irritating to the respiratory tract, and excitement is seldom an accompaniment of its use, but occasionally there may be observed laughter, delirium, and slight convulsive movements. During the period of narcosis the pupils are usually widely dilated. The corneal reflex is late to disappear. Salivation is unusual, and muscular relaxation is generally absent. Upon the patient's recovering some dizziness and unsteadiness of gait are apt to occur, but as a rule they disappear rapidly. It has been said that there are no undesirable sequels of pental anæsthesia, but this is certainly a mistake, for there are credible accounts of excitability, tremors, difficulty of speech, headache, erythematous eruptions, and even convulsive movements. Albumin, casts, and blood cells have been found present in the urine after its use. That pental anæsthesia may be safely conducted is no doubt true, but that it is a safe anæsthetic is questionable, to say the least. Temporary cessation of respiration with cyanosis is not infrequent during its administration, and Cheyne-Stokes respiration has also been observed. Moreover, the circulation has in some cases been much depressed, and death has undoubtedly been produced by it. These things, indeed, are scarcely to be wondered at, since experiments upon animals would seem to indicate that pental is a circulatory and respiratory depressant of considerable vigour.

Pental may be administered for anæsthesia in the same manner as chloroform. For a brief effect it may simply be dropped upon a cloth, but many prefer to employ an inhaler for the purpose, Junker's in particular being thought desirable. The use of pental for prolonged anæsthesia seems hazardous, but it has certainly been used thus with success. The amount of the remedy necessary to produce anæsthesia is usually from 1 to 3 drachms. It is said that some few individuals are insusceptible to its action.

The operations suited to pental anæsthesia are those that are brief, such as the extraction of teeth and the opening of abscesses. It has been particularly recommended for producing anæsthesia in children. Pental may be used as a *local anæsthetic* in the form of a spray.

[The *Lancet* for January 4, 1896, after mentioning Wood and Cerna's experiments on the physiological action of pental, and their consequent warning that it was a dangerous cardiac

depressant, says: "Rüth, as late as 1894, came to the opposite conclusion, asserting pental to be a safer agent than chloroform and possessing many advantages over ordinary laughing-gas. It has not, however, been extensively employed, except in dental practice. Mr. Constant, after experience of some hundreds of cases, was satisfied with its action, but did not speak very enthusiastically about it. In 1892 a death was reported as having occurred during the employment of pental, but the evidence, so far as could be elicited, did not conclusively prove that the anæsthetic was to blame in the case. In all these observers' hands the danger, such as was admitted, appears to have been that incurred by heart failure, although Rüth has expressly stated that respiration fails before the heart's action ceases. In the following case the patient was a woman aged twenty-three. She attended at the Dental Hospital in Devonshire Street, Chorlton-on-Medlock, for the purpose of having several teeth extracted. She was examined by the medical attendant who administers anæsthetics at that hospital, and was, in his opinion, in a fit state to undergo the operation and to take pental. This he administered, and she rapidly passed under its influence. After the extraction of five teeth her respiration ceased, and none of the means adopted to restore her succeeded. The dental student who had operated stated that there was no particular difficulty in the operation. Pental had been used by the anæsthetist for many patients, and he stated that he had never previously met with any difficulty or danger. We are not told whether the patient was at the moment of extracting the fifth tooth resuming consciousness. If so, possibly the mechanism of death was similar to what so often occurs under chloroform. On the other hand, Holländer in his first paper spoke of his patients being analgesic rather than unconscious, as if there were no danger of reflex shock under this anæsthetic. This, of course, is a point of great importance. At present pental is on its trial, and the fullest information concerning the action of the drug is desirable; every accident should be most carefully reported to see how far we can trust the favourable opinions so freely uttered about this substance, and how far Professor Wood is correct in his warning that 'pental will probably prove a most dangerous anæsthetic.'"

Dr. Prince Stallard, in a paper read before the London Society of Anæsthetists (*Lancet*, March 14, 1896; *N. Y. Med. Jour.*, April 4, 1896), said that at the ordinary temperature of a room pental was so volatile that it was necessary to administer it by the closed method, with the admission of as little air as possible. If it was dropped on to a piece of lint, as was usual with chloroform, a large quantity was required. In a hundred and forty-eight cases Clover's portable ether inhaler had been used. Two drachms of pental were poured into the reservoir, the indicator was placed at O, and the patient was encouraged to fill the small bag with his expirations; the indicator was then turned rapidly but evenly to 3; rarely was it necessary to turn to F. Pental was thus given more rapidly than was advisable with ether, and attention had been directed to the absence of coughing, struggling, and fighting for breath, so characteristic of the latter drug when given alone without the previous use of nitrous oxide gas. No restriction had been placed on the patients with regard to diet, and in only one case had there been after-vomiting. The clothing should be quite loose around the throat and abdomen so that the thoracic and abdominal movements could be quite free. All the administrations had taken place at about 10 A. M. In all the cases the patients had been seated in a dental chair, the head having been placed in an easy position midway between flexion and superextension. The horizontal posture, said Dr. Stallard, would be much safer, as signs of cardiac failure had not infrequently occurred in the cases cited, for pental, in this respect, resembled chloroform. When this drug was inhaled the pulse was at first quickened, also the breathing, and then the pulse became fuller and bounding, with dilatation of the capillaries of the face, which was evinced by extreme flushing, similar to that observed when nitrite of amyl was inhaled; swallowing movements were observed, but never any coughing or struggling; screaming might occur, and dreams of a pleasant nature were frequently experienced. Spasms, tonic and clonic, were occasionally present in the arms or in the legs. The lid reflex was usually present unless the anæsthesia was deep; when the patient was deeply under the influence of the drug the pupils were dilated and the eyeballs turned upward under the upper lids, and, in some cases, the conjunctival vessels were prominent and congested; the arm when raised dropped helplessly to the side. At the height of anæsthesia the pulse became small, and might be running. There was no cyanosis or duskiness of the features, and stertor was very rare. Micturition and defecation had never been observed. Opisthotonos and twitchings of muscles had been noted in a few cases, the patients having generally been tranquil. The breathing could hardly be heard; this, said the author, constituted one of the dangers, and, in this respect, pental again resembled chloroform. Recovery was extremely rapid, and was not followed by any stupor or drowsiness. As a rule, there were no after-effects; the patients felt quite well three minutes after the removal of the face-piece, and were able to walk out of the house. One case only of vomiting had occurred and three or four of nausea; slight headache had been noted in a few cases, but this had rapidly passed off. The average time required to produce anæsthesia had been fifty-six seconds, and the average anæsthesia obtained had lasted for seventy-six seconds. The preanæsthetic stage had varied from thirty to one hundred and twenty seconds and the anæsthetic period from twenty-five to two hundred and ten seconds. The advantages maintained for pental, said Dr. Stallard, were: 1. Longer anæsthesia than nitrous oxide gas yielded. 2. Simple apparatus. 3. No struggling, coughing, or dislike

to the drug. 4. The small amount required, which averaged 2 drachms. 5. Rapid recovery. 6. The absence of after-effects. The disadvantages were: 1. The insidiousness of its action—an overdose could easily be administered. 2. Noiseless and shallow breathing. 3. Screaming. 4. The sudden cessation of respiration. 5. Sudden cardiac failure.

Dr. Stallard said that he had frequently known decomposition of the drug to occur. With regard to albuminuria, he had examined the urine in twenty-five cases after its administration and found no albumin, but it must be remembered that all his cases had been short ones and the effect would not last long enough to injure the kidney. The fall of blood-pressure was marked. With regard to the length of anæsthesia obtained, he was of opinion that there was a marked personal factor in many cases.]—HENRY A. GRIFFIN.

PENTANE.—See AMYL HYDRIDE.

PEPO (U. S. Ph.) consists of the seeds of the common field pumpkin. It has been very extensively employed as a *tæniafuge*, and in many cases with gratifying results. Two ounces constitute an average dose. The seeds are bruised in a mortar or crushed in a coffee or spice mill and made with water into a sort of emulsion, the covering, or husk, being separated by passing the mixture through a coarse sieve, although it has been advised that they also should be taken. The only drawback to its use is the considerable bulk of a dose, which may excite nausea in certain cases. If failure follows the first dose, it may be repeated daily as long as the individual is willing. It is best taken in the morning, after the precautions mentioned in the article on ANTHELMINTHICS have been observed, and it should be followed by a laxative. No harm has ever followed the use of this remedy, and little seems to be known of the active agent in it. Fowls which have eaten the seeds and the soft portion of the fruit enveloping them are said to be affected with giddiness and a form of intoxication. An oil, an alcholic fluid extract, and a resin are prepared which seem to vary considerably, as both successes and failures have been reported as following their employment. The fleshy portion of the pumpkin has also been used, but it seems to be less efficient than the seeds.—RUSSELL H. NEVINS.

PEPPER, BLACK.—See PIPER NIGRUM.

PEPPER, CAYENNE.—See CAPSICUM.

PEPPERMINT.—See MENTHA PIPERITA.

PEPSIN (Br. Ph.), *pepsinum* (U. S. Ph., Ger. Ph.).—What is known under this name is by no means the pure gastric ferment, a body having the property of converting proteids into peptones, but is a mixture of that substance and various bodies derived from the mucous membrane of the pig's stomach, from which it is prepared. These latter are inseparable from the true pepsin and are present in varying proportions, depending upon the care with which the processes of manufacture have been conducted. The purest samples occur as a yellowish-white or white powder, either amorphous or somewhat grainy or scaly. They have a slight acid or saline taste and should be free from any unpleasant odour.

Pepsin is soluble in 100 parts of water, but the addition of small amounts of hydrochloric acid renders it soluble in less than half that quantity.

Many samples, while agreeing in appearance with those known to be active, are entirely inert, having deteriorated by keeping or having always been destitute of the slightest peptonizing powers in consequence of lack of care in their manufacture.

The U. S. Ph. calls for a pepsin which will completely digest—that is, render soluble—at least 3,000 times its own weight of the finely divided white of a hard-boiled egg when combined with 1,000 times its weight of a 2-percent. solution of hydrochloric acid and maintained for six hours at a temperature of not less than 100·4° or more than 104° F., the vessel in which it is contained being gently agitated every fifteen minutes. At the end of the given time little or no residue should be observed, but a few thin flakes of the coagulated albumen need hardly be regarded. The Br. Ph. requires that it shall dissolve 50 times its own weight of finely sifted coagulated albumen in thirty minutes when combined with a solution of 5 minims of hydrochloric acid in 1 oz. of distilled water and subjected to a temperature of 154° F.

For practical purposes the latter test is the most readily applied, and is one which should be made in all cases save when the most satisfactory evidence is presented as to the activity of the sample to be prescribed.

In accordance with the variations in the methods of preparation, three varieties of pepsin are found—one form entirely soluble in water, another soluble in slightly acidulated water, and a third insoluble in either.

There is but little difference in the activity of these varieties, but the insoluble variety is the most permanent and is but little liable to decomposition. The soluble specimens, when dissolved in water, are apt to spoil rapidly, and their solutions, when possessed of any unpleasant odour, are unfit to use. The addition of not over 20 per cent. of alcohol renders these solutions fairly permanent, although the activity of the pepsin is somewhat impaired.

What is known as "crystal pepsin" is practically the substance obtained by the self-digestion of the gastric mucous membrane of various animals, which is dried in thin scales and sifted so as to give it a crystalline appearance. It is usually quite active, but is not superior to the varieties prepared in the ordinary ways. No matter what precautions are exercised in the preparation of pepsin, it is undoubtedly true that there is a great difference in the activity of the different lots turned out by the same manfacturers, and often that made by those of indifferent reputation is entirely inert. Consequently it is of the highest importance that a reliable brand should be selected.

Unfortunately, nearly every drug is incompatible with this substance, the most notable

exceptions being codeine, bismuth subnitrate (which retards but does not diminish its activity), strychnine, nux vomica, lactate of iron, and lactic and hydrochloric acids. To obtain its maximum effects, it should be used in connection with either of the two last named, and nux vomica or strychnine may be advantageously added when a *stomachic tonic* appears to be indicated. Codeine or the bismuth salt may be added when *gastralgia* is a prominent symptom, and the latter when *diarrhœa* is present. Of the numerous vehicles for the preservation and administration of pepsin, glycerin is by far the best, and there is little reason for the employment of any other, although milk sugar is unobjectionable except when its presence in the stomach would be injurious. Saccharin has been suggested as a diluent, but there would seem to be no particular advantage in its employment. It is well, however, to note its perfect compatibility, as the simultaneous administration of the two might be convenient in *diabetes*.

As pepsin is only active in neutral or acid solutions, alkalies of any kind should not be administered with it or for some time after it has been taken. Exactly what takes place when it is combined with pancreatin is not well understood, but theory indicates that, as the one requires an acid medium to bring out its full effect, and the other an alkali, little benefit would be gained from their mixture. A number of preparations exist in which the two are found and from which good results have undoubtedly been derived, but there seems to be reason to believe that either the pepsin or the pancreatin alone would have been as effectual.

As a rule, it is best to administer pepsin shortly after eating and before the food passes from the stomach into the intestines. In addition to its peptonizing effect upon proteids it appears to act as a stimulant of the mucous membrane of the stomach, thereby increasing the natural secretions of that organ, and by some it is maintained that its beneficial action depends more upon the latter property than upon the former. The doses ordinarily given are inadequate, and many of the failures imputed to it are undoubtedly due to this fact. It is safe to say that in conditions where it is urgently demanded not less than 30 grains of the average article should be administered.

The conditions in which pepsin is indicated are *dyspepsia*, with a *sense of weight in the stomach* after eating and *eructations*, *vomiting of undigested food*, *lienteric diarrhœa*, especially in children, the *indigestion of phthisis*, *mucous gastritis*, *atonic dyspepsia*, and *cancer* and *ulcer of the stomach*. It is also very useful in the convalescence from acute diseases and in infants after weaning until the stomach has become accustomed to its new conditions. In some obscure cases of indigestion it may be necessary to adopt the procedure of testing the secretion of the stomach before it can be determined that there is a deficiency in the secretion of pepsin. This is performed by obtaining a specimen of the gastric fluid by a stomach-bucket or an œsophageal tube. After careful straining, the specimen is divided into four equal parts, to one of which pepsin is added, to another pepsin and hydrochloric acid, to the third hydrochloric acid alone, while to the fourth nothing is added. To each portion an equal bulk of coagulated albumen is added and the solvent effect of each is noted, the temperature of all of them being maintained a trifle over 100° F. In this way it can easily be determined whether the gastric juice is normal or whether pepsin or hydrochloric acid or both are lacking. The procedure is one which is rather unpleasant to the person from whom the specimen is obtained, and is only indicated in aggravated conditions.

A peptonized milk may be prepared, which may be used as a nutrient enema or for introduction into the stomach through the œsophagus or a fistula, by digesting 1 oz. of milk for an hour at a temperature of 100° F. with 5 grains of pepsin and 4 drops of hydrochloric acid. The product should be clear, and must be neutralized with a small amount of sodium carbonate. Meat and other albuminoids may also be treated in the same manner, but they are not very palatable and are hardly to be used except in desperate cases or in the same manner as the peptonized milk.

For the removal of the exudation of *diphtheria*, solutions of pepsin are sprayed into the throat, and often very great temporary relief is obtained, the effect, however, being purely local, so that the general constitutional treatment is not to be neglected. Similar solutions may be applied to *unhealthy suppurating surfaces* with a view to dissolving the superficial morbid tissues.

Saccharated pepsin, *pepsinum saccharatum* (U. S. Ph.), contains 1 part of pepsin to 9 parts of milk sugar. Unless that diluent is objectionable, it may be used in nearly all cases in which pepsin is indicated.

In conclusion, it may be stated that the greatest care should be taken that the purest possible brand is dispensed, and all tablets, troches, etc., are to be rejected. Nearly all of the elixirs and wines are inert, although, as already stated, a weak wine is entirely compatible with pepsin. The best vehicle is glycerin, and in all cases, except those of infants, lactic or hydrochloric acid should be given simultaneously.—Russell H. Nevins.

PEPTOMANGAN, *liquor mangano-ferri peptonatus*, is a liquid peptone preparation containing iron, manganese, and a small percentage of alcohol. Each half ounce contains the equivalent of 3 grains of metallic iron and 1 grain of metallic manganese. It is essentially a drug in its characteristics and in no sense a food. It occurs as a transparent, dark sherry-red liquid, of a slight agreeable odour and taste. It is neutral in reaction, non-astringent, and miscible with water, milk, or any wine free from tannic acid. It is used especially in the *anæmia of rhachitis*, *chlorosis*, and *phthisis*. Von Ruck reports its use in two series of cases of pulmonary tuberculosis. In the first series of twelve cases, with a single exception, after the use of this drug

the hæmoglobin increased materially. The smallest amount of increase was 3 per cent., the largest 46 per cent., while the red blood-corpuscles showed in different patients an increase ranging from 33,000 to 1,990,000. Each of these patients had been receiving the ordinary iron mixture previously, but had gained comparatively little in either hæmoglobin or corpuscles. Especially good results have also been reported in chlorosis and rhachitis. It is believed that in certain forms of anæmia manganese as well as iron is of material advantage, as it is fully demonstrated that this element occurs in the blood. The dose of peptomangan is a tablespoonful three or four times a day. It may be given alone, as it is not unpalatable. It may be diluted, if desired, with milk or water, or may be administered in any sweet wine free from tannic acid.

[Dr. Hugo Summa, of St. Louis (*N. Y. Med. Jour.*, Feb. 9, 1895), who has used Gude's peptomangan extensively in doses varying from a teaspoonful to a tablespoonful, in sherry or milk, three times a day, an hour after meals, reports excellent results in *chlorosis* and *anæmia*. Dr. Summa lays stress on the fact that this preparation does not give rise to constipation.]—FLOYD M. CRANDALL.

PEPTONIZED MILK.—See under MILK.

PERMANGANATES. — *Potassium permanganate, potassii permanganas* (U. S. Ph., Br. Ph.), *kalium permanganicum* (Ger. Ph.), is a highly oxidized salt, and, parting with its oxygen with great readiness, is of considerable value as a *deodorizer* and *disinfectant*, but its relatively high cost and the property it possesses of imparting a red stain, removable by oxalic acid, prevent its extensive employment. It may be advantageously used to disinfect or deodorize *ulcerating surfaces* from which offensive odours are given off, as in *hospital gangrene, carbuncles*, etc., and as an injection in *otorrhœa, ozæna*, or *leucorrhœa*. Its effects, however, are rather transient and it must be used oftener than the other disinfectants employed in the conditions mentioned. Solutions of 1 grain in 1 oz. of water are often employed to overcome the *axillary odours* and those arising from *sweaty feet*, also as a *tooth-wash*.

The ordinary strength of a solution for application to wounds, etc., is from 5 to 10 grains to the ounce of water. Stronger solutions act as stimulants, and are often employed upon raw surfaces where a stimulating effect is desired. Occasionally the finely powdered salt is sprinkled upon unhealthy wounds, etc., with the result of obtaining a mild escharotic effect.

Condy's fluid, or solution, is an aqueous solution of this salt to which aluminium sulphate is added under the belief that it greatly promotes the oxidizing effect of the permanganate. It may be employed for the same purposes as an extemporaneous solution.

Internally, the permanganate has been used in the treatment of *scarlet fever* and of *diphtheria*, the throat being sprayed or swabbed with a 1-per-cent. solution. It has also been employed in all the so-called zymotic diseases, especially *erysipelas, puerperal fever*, and *septicæmia*, but its efficacy in these affections is denied by many. In the treatment of the *bites of poisonous reptiles* and *rabid animals* it was long ago brought forward as almost a specific, but the evidence for and against its employment is rather conflicting, so that it would be wise neither to trust to it alone nor to neglect it if it is at hand, the wounds at the same time being washed out with a 4- or 5-per-cent. solution.

In *delayed* or *arrested menstruation*, especially in young women and those affected with *anæmia*, it appears to be of considerable value. From 1 to 2 grains are to be given three times a day, and the doses are to be continued for two or three days after the establishment of the flow. It is also said to assist in the removal of fatty tissue, and has been vaunted as a cure for *obesity*. In some forms of *flatulence*, especially that occurring in the obese, it has been used with good effects, and by some is esteemed highly in *lithiasis*, in which it seems to be more effectual when inclosed in capsules which do not dissolve until they enter the intestines.

It is of importance that potassium permanganate should not be combined either in solution or in substance with organic matters, as it is rapidly reduced in their presence, and spontaneous combustion is said to have sometimes occurred. When it is administered in the pill form, which is by far the best form for its use, kaolin and vaseline are the best excipients, or it may be compressed into pills. The usual dose is 1 grain, although the size of the dose may be as large as 4 grains without any ill results. The *liquor potassii permanganatis* (Br. Ph.) is a solution of 4 grains to the ounce of distilled water. It may be given in doses of from 2 to 4 fl. drachms. All solutions and the salt itself should be kept in tightly closed receptacles and in a dark place.

[For further information concerning potassium permanganate, see under MANGANESE, vol. i, pages 596 and 597, and under OPIUM, vol. ii, page 44.]—RUSSELL H. NEVINS.

PEROSMIC ACID.—See OSMIC ACID.

PEROXIDE OF HYDROGEN. — See HYDROGEN DIOXIDE.

PETROLATUM.—See VASELINE.

PETROLEUM, or the mineral oil which occurs in many parts of the world, varies in colour from a light green or red to black, and has a distinctive odour which in certain varieties is highly offensive on account of the presence of numerous sulphur and phosphorus compounds. It is more largely used in the arts than in medicine, but enjoys some repute, more especially in domestic medicine, as a local application in the treatment of *rheumatism, pulmonary affections, chilblains*, and other conditions in which a moderate degree of irritation of the skin is desired. Combined with oil of turpentine, linseed oil, and the oils of amber and juniper, it constitutes "British oil," a rubefacient liniment, more employed in veterinary medicine than in practice on the human subject. Under the name of "Seneca" oil it was at one time regarded as a specific in

phthisis, but beyond producing a slight expectorant effect it is of little value.

Tapeworms are said to have been expelled by doses of from 20 to 40 drops given three times a day. Petroleum has been substituted for vaseline in the treatment of *psoriasis*, and may be used in the treatment of *scabies*. It is somewhat *antiseptic*, but is rather too offensive to be used except upon animals. In poultry houses and dovecotes it is probably the best agent that can be found for the destruction of insects, the woodwork, etc., being painted with it from time to time.

Refined petroleum, or *kerosene* (*q. v.*), is highly esteemed by many ignorant persons as a universal remedy, but is probably without any effective therapeutic action except as an irritant of the skin.—RUSSELL H. NEVINS.

PETROSELINUM, or parsley, *Apium Petroselinum*, is largely used for culinary purposes, and from a medical standpoint is chiefly interesting on account of its being the source of apiol, which possesses all the virtues assumed to exist in the plant, and is to be preferred on account of its smaller bulk. The fresh root is reputed to be *laxative* and *diuretic*, and the herb itself *antiperiodic*. The seeds are thought to be *antiperiodic* and *emmenagogue*, and play a more or less important part in domestic medicine. They are probably more active than any other part of the plant. They may be given in doses of half a teaspoonful. (Cf. APIOL.)

[Fresh parsley, steeped in vinegar and eaten immediately after eating onions, is useful in removing the offensive odour of the breath.]

RUSSELL H. NEVINS.

PHELLANDRIUM.—The fruit of *Phellandrium aquaticum*, the water-hemlock, was formerly official in various pharmacopœias, and was esteemed a useful *sedative* in the treatment of *cough*, also *tonic* and *stomachic*. From 5 to 8 grains may be given three times a day, and the dose may be gradually increased to 15 grains. In large doses, the drug is said to be a narcotic poison.

PHENACETINE, *phenacetinum* (Ger. Ph.), was first prepared by Hinsberg, chemist of the colour factories of Bayer & Co., in Elberfeld, and was first subjected to trial by this author, with Kast and Freiberg, in 1887. Soon afterward its value as an *antipyretic* was demonstrated at Bamberger's clinic in Vienna. Phenacetine, $C_6H_4\langle^{OC_2H_5}_{NH(CH_3.CO)}$, is an acetyl compound of phenetidine—that is, of the ethyl ether of paramidophenol. Its composition is thus analogous to that of acetanilide. It is a colourless or slightly reddish, odourless, and tasteless powder, sparingly soluble in water, somewhat more soluble in glycerin, and readily soluble in alcohol, especially hot alcohol. It is insoluble in acid or alkaline fluids, hence in the acid gastric juice and in the extract of pancreas. It is demonstrated in the urine by the red colour produced by liquor ferri sesquichloridi and by the green colour produced by sulphate of copper.

It has no effect upon the temperature in health, but a remarkable antipyretic effect, even in small doses, in *fever*.

From Mahnert's comparative tests it was found that 14 grains of phenacetine lowered the temperature more than 15½ grains of antipyrine, quinine, or kairin, and more than 3·1 grains of thalline. It is less apt to be followed by perspiration than thalline and acetanilide, by ringing in the ears than the salicylates, by dizziness than quinine, and by chills than acetanilide.

In summing up the evidence, it is found that phenacetine, while as prompt and efficient as any of the antipyretics, is the safest of all of them. After a dose of 15 grains the temperature falls rapidly, reaching its lowest point in about three hours, and remains low for from eight to ten hours, when it again rises somewhat, with the appearance of an abundant perspiration. Too great depression is followed by chilly sensations, attended occasionally, especially in certain subjects, with a feeling of weakness, sometimes of faintness, due to heart failure. Small doses are, however, unaccompanied with evil effects of any kind. Any sinking sensations may be speedily combated by alcohol, as by a glass of wine or a drink of whisky, and anything like excessive sweating may be prevented or controlled by the use of atropine. Phenacetine is a powerful analgetic, and, notwithstanding its insolubility, begins to act in twenty minutes. And although it may by no means be compared with morphine in the relief of pain, it has a more distinct anodyne influence than antipyrine or acetanilide in the various *neuralgias*, and is especially valuable in the treatment of any ordinary *headache*, of *migraine*, *gastralgia*, *sciatica*, *neuritis*, and of the *insomnia of diseases of the uterus*, *floating kidney*, *exhaustion from overwork*, etc. (Cohn). A small dose, say 5 grains, of phenacetine, taken at bedtime, may have a very soothing effect in allaying the anxieties and hyperæsthetic states which prevent sleep.

Unpleasant after-effects are at times due to unconverted paraphenetidine, which is poisonous in small dose. This substance acts especially upon the kidneys, causing nephritis with albuminuria. The presence of this impurity may be detected by the following test: If 38 grains of chloral hydrate are melted in a small test-tube in a water-bath with 7¾ grains of perfectly pure phenacetine, the solution will remain absolutely colourless upon shaking for at least five minutes, but after that time will assume a rose-red colour. If any paraphenetidine is present, the solution becomes coloured in two or three minutes to a more or less intense violet. Phenacetine is much less toxic. It seldom or never produces chill, cyanosis, or collapse. It very rarely causes nausea or other disturbance of digestion.

Phenacetine is considered by most authorities as an ideal antipyretic. It should be given in doses of from 5 to 10 grains, never more than 15 grains. For children, the dose ranges from 2 to 4 grains, with 5 grains for the maximum.

[There is some difference of opinion as to the efficiency of phenacetine as an antipyretic

and as to the non-occurrence of ill effects from its use. For example, an editorial writer in the *British Medical Journal* for Dec. 22, 1894, says, with regard to the impression that phenacetine does not produce evil effects, that it has been "somewhat justified by experience"; nevertheless, he goes on to say, we may meet with unpleasant and profuse diaphoresis, rendering its habitual use in phthisis and typhoid fever undesirable. Collapse and exhaustion are not unknown even after moderate doses, while palpitation and oppression of breathing followed by nausea and vomiting have also been observed. Cutaneous eruptions, chiefly urticarial, prevail with a frequency scarcely inferior to that observed in the employment of antipyrine, and cyanosis of the face, due to changes in the hæmoglobin, may be seen in a similar degree. The usefulness of phenacetine as an antipyretic remains small, he continues, as its power in that respect is not equal to that of the others, except when it is employed in doses that very often give rise to toxic symptoms.

Krönig (*Berlin. klin. Woch.*, Nov. 18, 1895; *University Med. Magazine*, March, 1896) has related a fatal case of poisoning with phenacetine. The subject was a boy, aged seventeen, who presented the general appearance of sepsis. He was the subject of a chronic suppurative otitis media. The general condition, however, indicated some profound alteration in the blood, such as is not seen in cases of sepsis. An examination of the blood revealed the red cells in various stages of dissolution. Even the apparently healthy cells showed considerable changes in age and shape. Thus there was reason to suspect the presence of some blood-poison. The history was that three weeks before his admission the patient had been given by his physician five powders of phenacetine, each containing 15 grains of the drug, with the direction that not more than two should be taken in the day. Within three weeks he had taken four of these powders without much improvement in his condition. One evening he took another powder, and in the night he was seized with vomiting. On the following day he had headache, vomiting, and diarrhœa. He was somewhat cyanotic. His urine was of a chocolate colour, and subsequently contained blood. The cyanosis increased, and he died in two days, within three days after taking the last powder. The appearances resembled those of chlorate-of-potassium poisoning. In the discussion Fränkel, Fürbinger, and Gerhardt, all strongly emphasized the importance of giving small doses of drugs like phenacetine in the first instance.

Phenacetine has been much used in the early fever of *influenza* as an antipyretic and as an analgetic in *migraine*, *rheumatism*, and various forms of *neuralgia*. Bocquillon-Limousin gives the following formula for its external use in *acute rheumatism*, which he attributes to Taylor:

℞ Phenacetine..... 90 grains;
Lanolin..... 300 "
Olive oil, a sufficient quantity.

Mix for an ointment to be rubbed gently on the painful parts.]—JAMES T. WHITTAKER.

PHENATES.—Salts of carbolic acid (see CARBOLIC ACID).

PHENAZONE.—See ANTIPYRINE.

PHENEDINE.—See PHENACETINE.

PHENIC ACID.—See CARBOLIC ACID.

PHENIDINE, or *paraacetphenetidine*, according to Cerna, has been considered superior to antipyrine as an *analgetic*. He gives the dose as 15 grains. Phenidine seems to be one of the drugs that should not be used in practice, unless with the greatest caution, until more is known of its properties.

PHENOCOLL, or *amidophenacetine*, is produced by the action of glycocoll, which is an amidoacetic acid, upon phenacetine. Phenocoll is a white crystalline powder, soluble in water in the proportion of 1 to 16 parts. It reduces *fever* much more rapidly than phenacetine, and by diminution of heat production without affecting the radiation of heat. Phenocoll hydrochloride is given in doses of from 5 to 15 grains. It has no unpleasant after-effects, excepting occasionally profuse perspiration. But the remedy must be used with caution in cases of great prostration, as it may produce, in exhausted states, dyspnœa, cyanosis, and heart failure.

[The formula of phenocoll has been stated to be $C_6H_4\begin{smallmatrix}OC_2H_5\\NH.OC.CH_2NH_2\end{smallmatrix}$. The hydrochloride is the form in which it has been used most, but an acetate, a salicylate, and a carbonate have been employed. It has been used as an *antipyretic* in the *fever of phthisical subjects* and other *febrile conditions*, particularly that of *influenza*, and as an *analgetic* in *acute articular rheumatism* and in *neuralgia*.

Vargas, of Barcelona (*Therap. Woch.*, Jan. 5, 1896), employed phenocoll in the treatment of *whooping-cough* in forty-two cases during the period from February, 1894, to June, 1895, and he declares that it is far superior to any other remedy for that disease that he has ever tried. In every one of his forty-two cases its effect was shown within the first twelve hours, although in many of them the frequency of the paroxysms was not reduced until the next day. Even in children of a very tender age he has not observed any untoward action of the drug. He gives the hydrochloride in daily amounts of from 1 to 30 grains, according to the patient's age; he has always used it dissolved in water to which sugar or gum arabic has been added. He remarks that it is absorbed very rapidly and eliminated promptly. He thinks that the efficiency of phenocoll hydrochloride in whooping-coug his not due to its antibacterial action, but to its acting as a sedative.

Albertoni, of Bologna, has found phenocoll an efficient remedy in *malarial fevers*.]

JAMES T. WHITTAKER.

PHENOCOLL SALICYLATE.—See SALOCOLL.

PHENOL, in its chemical sense, is a class name applied to benzene derivatives in which one or more atoms of hydrogen in the nucleus have been replaced by a corresponding number of molecules of the compound radicle hydroxyl, OH. Thus there are monatomic, di-

atomic, triatomic, tetratomic, pentatomic, and hexatomic phenols. There is derived from benzene but one monatomic phenol, carbolic acid, and it is to this that the name phenol is given in pharmacy. (See CARBOLIC ACID.) From these facts it has come about that various remedial combinations into which carbolic acid or another phenol enters, as well as certain drugs which are truly phenols, have borne a part or the whole of the name phenol as significant in some degree of their composition. The number of these combinations is very large; a few of them are official, some are of recognised scientific status and worth, and more of them are proprietary. It would scarcely be possible, even were it desirable, to consider these last extensively, and as for the second class, they are, for the greater part, considered elsewhere in this work. I shall therefore limit the consideration here to the few which bear the name phenol entire and are in common employment.

Camphorated phenol is a mixture of 1 part of carbolic acid and 2 parts of camphor, which, after standing for some hours, is purified by washing with water. It is a liquid of a reddish-yellow colour with the odour of camphor. It is insoluble in water, but soluble in alcohol and in ether. It is recommended by Bufalini, who believes that the camphor diminishes the caustic action of the carbolic acid without otherwise lessening its effectiveness. Its use is for external application and similar to that of carbolic acid.

[Dr. Thomas A. Elder, of Aurora, Illinois (*N. Y. Med. Jour.*, Apr. 28, 1894), has used a "carbolate-of-camphor" ointment, consisting of 1 part of crystallized carbolic acid, 3 parts of camphor, and from 3 to 5 parts of vaseline, applied externally, in the treatment of *smallpox*, and reports that it relieved the itching at once and made the patients comfortable.]

Iodized phenol, *phenol iodatum*, iodized carbolic acid, *acidum carbolicum iodatum* (Nat. Form.), is a mixture composed of 20 parts of iodine, 76 of carbolic acid, and 4 of glycerin. It should be kept in a dark place and in glass-stoppered bottles.

Another preparation which bears the name of iodized phenol was suggested by Dr. Robert Battey (*Am. Pract.*, Feb., 1877) for use as a *uterine caustic*. It is prepared by slightly heating 1 oz. of carbolic acid with ½ oz. of iodine. It may be diluted with glycerin if necessary. A similar preparation containing 4 grains each of iodine and carbolic acid dissolved in 10 drachms of glycerin is sometimes known as *iodated phenol*. (Cf. ANNIDALIN.)

Phénol sodique is a French proprietary preparation, but the name is used as a synonym for solution of carbolate of sodium, *liquor sodii carbolatis* (Nat. Form.), a solution of 30 parts of crystallized carbolic acid and 2 parts of soda in 28 parts of water. It should be prepared fresh when needed. It is *antiseptic* and *sedative*, and, diluted with water, may be applied on lint as a dressing for *abrasions* and *wounds*.—HENRY A. GRIFFIN.

PHENOSALYL.—This is a French proprietary mixture of various antiseptics based on Bouchard's idea that a mixture of such drugs has a heightened antiseptic action without a corresponding increase of poisonous properties. Phenosalyl is said to be composed of 9 parts of carbolic acid, 1 part of salicylic acid, 2 parts of lactic acid, $\frac{1}{10}$ of a part of menthol, and ½ a part each of eucalyptol and oil of gaultheria, dissolved in glycerin (in what amount is not stated). The foregoing is the formula given by Soulier (*Memento formulaire des médicaments nouveaux*); Blanc (*Rev. de thérap. méd.-chir.*, March 15, 1893) mentions the same ingredients, except the oil of gaultheria, but does not give the proportions; and a writer in the *Wiener medizinische Wochenschrift* for June 10, 1893, says that benzoic acid is one of the constituents. The Squibbs (*Ephemeris*, etc., Jan., 1894) say that the active ingredients are dissolved in four times their volume of glycerin.

Phenosalyl is a colourless, syrupy liquid which becomes brownish if much exposed to light. On this account it should be kept in blue bottles. It is soluble in water in the proportion of 7 per cent. As compared with a number of other well-known antiseptics, phenosalyl acts as a *germicide* in very weak solutions. Duloroy (cited by Blanc) found that cultures of various micro-organisms were sterilized by a minute's contact with it in the following proportions:

The cholera spirillum by a 1-to-1,000 solution.

The *Bacillus anthracis* by a 3-to-1,000 solution.

The pneumonia coccus by a 4-to-100 solution.

The *Bacillus pyocyaneus* by a 4-to-100 solution.

The *Bacillus typhi abdominalis* by a 5-to-1,000 solution.

The *Bacillus diphtheriæ* by a 5-to-1,000 solution.

The *Bacillus tuberculosis* by a 4-to-1,000 solution.

The *Staphyloccus pyogenes* by a 7-to-1,000 solution.

For *sterilizing instruments*, a 2-per-cent. solution is employed. A 1-per-cent. solution has been found efficient as an injection in cases of *vaginal* and *uterine catarrh* and in *gonorrhœa*. Phenosalyl is not much inferior to corrosive sublimate as a germicide, and it has the great advantage of being far less poisonous; but, as Blanc says, there is nothing to hinder the practitioner from making similar mixtures of antiseptics for himself, varying the formula according to the case. In strong solution in glycerin, phenosalyl is a caustic. In 5-per-cent. solution its application to the interior of the uterus, after curetting, has been found very efficient in cases of *septic fever due to retained portions of the placenta*.

PHENYLACETAMIDE.—See ACETANILIDE. An *ammoniated phenylacetamide* known by the trade name of *ammonol*. It has a strong smell of ammonia, and is said to be at once *antipyretic*, *analgetic*, and *stimulant*. It has been used chiefly in the treatment of *rheumatism*, *neuralgia*, and the *sequelæ of alco-*

holic excess. The presence of ammonia in a more or less free state is said to give it the additional properties of an *expectorant*, a *diuretic*, and an *antacid.* Ammonol, according to the *Lancet*, is also prepared in the form of salicylate, bromide, and lithiate.

PHENYLAMINE.—See ANILINE.

PHENYL FORMAMIDE.—See FORMANILIDE.

PHENYLHYDRAZINE, $C_6H_8N_2$, is an oily liquid without colour, but of a faintly aromatic odour. It is crystallizable on cooling. It is not used as a remedy, but is the basis of a very delicate test—Fischer's test—for the detection of sugar in urine. The test depends upon the union of phenylhydrazine hydrochloride with grape sugar to form a highly characteristic crystalline substance called *phenylglucosazone.* It is applied as follows: "To 25 cubic centimetres of suspected urine add 1 gramme of phenylhydrazine hydrochloride, 0·75 gramme of sodium acetate, and 10 cubic centimetres of distilled water in a capsule. The capsule should be placed in a water-bath and warmed at least an hour, then removed and allowed to cool; and if sugar be present even in minute quantity, there forms a yellowish deposit, which may appear amorphous to the naked eye, but which, when examined under the microscope, is seen to contain fine, bright-yellow, needle-like crystals, either single or in stars—*phenylglucosazone*—which melt at 204° C. The presence of small or large yellow scales or powerfully refracting brown spherules must not be taken for evidences of sugar, as only the bright-yellow, needle-like crystals are conclusive" (Purdy, *Practical Uranalysis and Urinary Diagnosis*, 2d ed.). This test is exceedingly sensitive—more so, indeed, than either the Fehling test or that by fermentation. It has also the pronounced advantage over the Fehling test of not responding to a number of urinary ingredients, such as uric acid, hippuric acid, creatinin, and pyrocatechin when in excess. It will, it is true, yield yellow needle-shaped crystals with urine containing glycouronic acid and pentose, but the former will often disappear on stopping the medication, to which its presence is often due. Aside from this, however, glycouronic acid and pentose are seldom present in the urine in amounts sufficient to give the reaction. The phenylhydrazine test, therefore, is one of the utmost reliability and delicacy, though the manipulations it involves (the determination of the melting point of the crystals should be included in testing) render it somewhat troublesome. Attempts to modify and to simplify the test have been made, but these modifications can not be said to be free from objections. Because of the irritating property of phenylhydrazine hydrochloride, its manipulation should be attended with much care.

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PHENYL HYDRIDE.—See BENZENE.

PHENYL SALICYLATE.—See SALOL.

PHENYLURETHANE. — See EUPHORINE.

PHLEBOTOMY. — See BLOODLETTING. For *hepatic phlebotomy*, see under ASPIRATION, vol. i, page 151.

PHLORIDZIN, *phlorizin*, or *phlorrhizin*, is a crystalline glucoside, $C_{21}H_{24}O_{10} \times 2H_2O$, obtained from the bark of the apple tree, the plum tree and some other fruit trees, occurring in silky needles, of a sweetish taste and a bitter after-taste, soluble in hot water and in alcohol. It has been used to some extent as an *antipyretic* and *antiperiodic* in *malarial fevers*, in daily amounts of from 15 to 30 grains. Large doses produce temporary glycosuria, the so-called artificial diabetes; given to animals to the amount of 8 grains for each $2\frac{1}{2}$ lb. of the animal's weight, it causes this result.

PHOSPHATES.—See under PHOSPHORUS.

PHOSPHERGOT.—This name has been applied to an exhilarating mixture of ergot and sodium phosphate (see under ERGOT).

PHOSPHIDES, PHOSPHITES. — See under PHOSPHORUS.

PHOSPHO-ALBUMIN, otherwise called *dioleyllecithin*, a preparation that has been a good deal used in the Western States, is said to be "not secret, patented, or copyrighted." It purports to be an extract made from the testicles, spinal cords, and brains of young bulls, and to contain lecithins, spermine, phosphorized albumins, and nuclein. It is used internally as a *tonic* and *reconstructive*, especially in the various forms of *neurasthenia*, in *anæmia*, and in *phthisis.* Dr. S. V. Clevenger, of Chicago, has found it of great service also in the *circulatory derangements of the climacteric.* It may be given in doses of a tablespoonful, after eating, from once to three times a day.

PHOSPHORUS (U. S. Ph., Br. Ph., Ger. Ph.) is a non-metallic element obtained chiefly from bones. It is a waxlike substance at the ordinary temperature, translucent and nearly colourless. Its surface may become red or black upon long keeping. Its odour and its taste are characteristic, but tasting it, unless it is greatly diluted, is highly dangerous. Upon exposure to air, phosphorus gives off white fumes which are luminous in the dark; if the exposure is prolonged, it takes fire spontaneously. For this reason it is kept under water and in strong, carefully closed vessels, and protected from heat and light. Although phosphorus yields its odour and its taste to water, it is practically insoluble in it. It is somewhat soluble in absolute alcohol, more soluble in absolute ether, still more soluble (in about 50 parts) in any fatty oil, and very soluble in chloroform. Besides the ordinary form in which phosphorus appears, there are several allotropic forms. Of these, the most important are white phosphorus, black phosphorus, and red phosphorus. *White phosphorus* is produced when phosphorus is long kept in ordinary water, being a sort of incrustation formed upon the surface of the mass. It is said to be due to erosion of the phosphorus by the free oxygen the water contains. It does not appear upon phosphorus which is ex-

posed to water containing no air. *Black phosphorus* results from a peculiarity in the mode of cooling liquid phosphorus. Neither white nor black phosphorus is employed in medicine. *Red phosphorus*, also called *amorphous phosphorus*, is formed when phosphorus is exposed for some time to a heat of between 419° and 482° F. without contact with air. It is a hard, brittle solid, and, though it is decomposed upon long exposure to air, the necessary exposure is so long as to make red phosphorus for all practical purposes permanent. Because of this it is a far safer thing to handle and to transport than ordinary phosphorus, but its greatest recommendation lies in the fact that when pure it is entirely non-poisonous. It is said to have the same systemic action as the vitreous form of phosphorus and to be free from irritant properties. For these reasons, and because it is almost devoid of taste and odour, it would seem a desirable form in which to administer phosphorus, and, indeed, its use has been strongly urged. It is, nevertheless, little employed in medicine.

Although the belief that phosphorus is a diffusible general *stimulant* is scarcely entertained at the present time, it certainly is *tonic* and *nutrient* to the tissues in general and to the nerve-centres in particular. It is a constituent of many of the tissues, and therefore its medicinal employment is rational. Furthermore, its use in disorders of the nerve-centres is often followed by the most gratifying results, and direct experiment upon animals has shown that from its administration there follow a thickening of the spongy tissue of bones and a greater compactness of the dense portions, bony deposits, too, taking place inside the shafts of the long bones even to complete obliteration of the cavity within. As to the form in which phosphorus acts, when absorbed, opinions differ, but there is much reason in support of the belief that it acts in its elementary form and not in combination. From the administration of small doses of phosphorus no immediate symptoms are observed. When the doses are slightly increased, however, there follows slight gastric warmth, and doses larger still cause burning pain in the epigastrium, perhaps with some tenderness. The continued use of phosphorus may cause severe dyspeptic symptoms, and phosphorous eructations may be a disagreeable occurrence. The evidences of its beneficial action are seen in an increase of functional activity throughout the body; secretion is augmented, mental and bodily vigour are enhanced, and nutrition is improved.

Poisoning with Phosphorus.—When a poisonous dose of phosphorus has been taken, the toxic symptoms do not appear at once, for time is required for the drug to undergo solution and oxidation. The duration of this period will depend largely upon the form in which the poison has been administered, being shorter when it has been given in oily solution and longer when it has been taken in substance (match-heads are a frequent means of self-destruction). After an interval which may vary from one to twelve hours there occur prostration, nausea, vomiting, and epigastric pain and tenderness. The vomitus is of food, mucus, and bile, and for some time smells strongly of phosphorus and is luminous in the dark. The vomiting may be persistent throughout the duration of the condition, but not infrequently it disappears on the second or third day, to return later. The abdominal tenderness, however, remains and generally spreads, being particularly severe in the hepatic area. The temperature is generally elevated, thirst is excessive, the tongue is furred, and prostration is marked. The condition of the bowels is variable; in some cases the movements are normal, but diarrhœa may be present or, on the other hand, constipation. The stools in some cases, like the vomitus, are luminous. Later on, the movements are clay-coloured and sometimes bloody. At any time between the second and the fifth day jaundice appears and rapidly grows worse, and from now on the symptoms observed are the same as those of acute yellow atrophy of the liver. The mental condition, up to this time one of restlessness and anxiety, now becomes much disturbed. Delirium appears, varying in type and severity; afterwards stupor supervenes, then coma, ending in death. Spasmodic muscular contractions are common, also tremors, sometimes paralysis, and occasionally general convulsions. The fever is variable and irregular, but not infrequently the temperature becomes subnormal before death. Vomiting returns with the jaundice and is severe, and the vomited matter now contains blood or more commonly matter resembling coffee grounds. The urine is diminished in quantity and is high-coloured, containing both biliary acids and bile pigment. It is albuminous and often contains glucose, leucine, and tyrosine. Sarcolactic acid is generally present. The urine in some cases is suppressed. As in malignant jaundice, the liver is at first increased in size, but later, provided life is sufficiently long maintained, it rapidly becomes atrophied.

Deviations from the usual symptomatology of poisoning by phosphorus are not rare. Exceptionally death may occur within twenty-four hours, and from collapse. Under these circumstances jaundice does not occur and the symptoms are not typical. Death may take place at a later time, even without the appearance of jaundice. In women there may occur metrorrhagia. The duration of the larger number of cases is days, it may be weeks, and if recovery follows, it is slow and tedious. The post-mortem changes observed in persons dead of acute phosphorus poisoning are fatty degeneration of most of the soft parts, especially the liver, the stomach, the intestines, and the kidneys. The liver varies in size according to the period at which death has taken place. It is often large, softened, and light-coloured or mottled. The hepatic cells are infiltrated with fat globules; in the later stages they are broken down. There is catarrhal inflammation of the bile ducts. The kidneys undergo acute degeneration, the renal epithelium being infiltrated and then broken down. The mucous membrane of the stomach and intestines is thickened and grayish. The epithelial cells are

infiltrated with oil globules and granular matter, or are destroyed. The heart muscle is not uncommonly the seat of fatty degeneration, as the voluntary muscles and, in fact, almost any of the soft parts may be. Hæmorrhages and ecchymoses may be found in various parts of the body, and the blood is dark and fluid.

The treatment of acute phosphorus poisoning must be instituted early if success is to follow, for when the poison is once absorbed no remedies will directly counteract its effect. In all cases the first remedy which should be employed is *sulphate of copper*, for not only is it emetic, and therefore will cause elimination, but it is also a chemical antidote. It should be given in dilute solution, in the dose of 3 grains, and repeated every five minutes until vomiting occurs. It is recommended by some that, following emesis, the use of copper sulphate should be continued in doses of $\frac{1}{12}$ of a grain at intervals of twenty minutes. Most authorities prefer to administer turpentine after emesis has been brought about by the copper salt. It is not the ordinary turpentine which is thus useful, for that is of no effect, but the acid *French turpentine*, which with phosphorus forms a soft crystalline mass called turpentine-phosphoric acid, which is harmless. *Magnesia*, too, should be administered, or the *sulphate* or *citrate of magnesium*, in order that the bowels may be rapidly and effectively opened and elimination be thus promoted. *Potassium permanganate* is preferred by some to turpentine. It may either be given by the mouth or, in a 1-to-1,000 solution, may be used to wash the stomach. A pint of this solution has been used with success half an hour after the poison had been taken. Oils are to be avoided in all cases, because of the solubility of phosphorus in oil. Further than this the treatment must be symptomatic, anodynes and stimulants being generally demanded.

[Dr. E. Q. Thornton, of the laboratory of therapeutics of the Jefferson Medical College, Philadelphia (*Therap. Gaz.*, January, 1893), from his experiments in the laboratory, concludes that permanganate of potassium is the best antidote. It must be used, he says, before the poison has become absorbed, and must be well diluted (in a ½- to a 1-per-cent. solution), or vomiting will result before the desired chemical reaction has taken place in the stomach. It must be given in excess, as considerable permanganate is reduced by the organic substances in the stomach. While sulphate of copper and phosphorus are chemically incompatible, and reaction occurs instantly when they are brought into contact, they decidedly complicate a case of phosphorus poisoning, says Dr. Thornton, by causing severe gastro-enteritis. Any substance intended to act as a chemical antidote in the stomach, he remarks, must be given in excess, so that it may come in contact with all the poisonous material; but with sulphate of copper, whether given in excess or in the same chemical proportions required to make the change, violent gastro-intestinal inflammation results. In all his experimental cases of phosphorus poisoning in which sulphate of copper was used as an antidote death resulted, although the animal to which the solution of peroxide of hydrogen was administered recovered after poisoning by phosphorus. Unchanged phosphorus was vomited and passed by the bowels by this animal, and severe gastro-enteritis resulted. Peroxide of hydrogen, Dr. Thornton thinks, is too slow in oxidizing the phosphorus, and too irritating to the digestive tract to be a valuable antidote. Dr. Thornton says that, inasmuch as the old French oil of turpentine can not be obtained in this market, it should cease to be considered as a practical antidote.]

Besides the acute phosphorus poisoning there is observed a *chronic form of poisoning* by this element. It is not from its internal use that this variety of poisoning proceeds, but from the continued inhalation of phosphorus in vapour, to which workers in certain manufactures, especially of matches, are exposed. From this exposure there result symptoms due to irritation of the respiratory and the digestive mucous membranes. Cough is generally present, and not infrequently there are anorexia, dyspeptic symptoms, constipation, and debility. Impotence and paralysis have been observed. The most remarkable phenomenon in these cases, however, is necrosis of the maxillary bones, the inferior maxilla in particular. The severity and extent of this necrosis are variable, but the curious fact about it is that unless the teeth are carious the necrosis does not take place, access of the poison to the maxillæ being prevented. The surest treatment of the chronic form of phosphorus poisoning lies in withdrawal from the contaminated atmosphere, but it is said that workers in phosphorus may prevent injury from the vaporized element by suspending bottles of oil of turpentine about their necks, that the well-known antagonism between the vapours of turpentine and of phosphorus may be brought into play. This expedient may be successful, but, though it may prevent phosphorus poisoning, it is difficult to see how injury from the inhalation of vaporized turpentine can be assured.

The therapeutics of phosphorus is indicated by its physiological action; malnutrition of nerve and bony structures constitutes the chief field of its usefulness. In *cerebral atony* and *mental enfeeblement* its action is often excellent, and even if the symptom is a result of organic changes in the brain phosphorus is not always useless. Indeed, in *cerebral endarteritis*, in *cerebral softening*, and in *paralysis of cerebral origin* it may be serviceable, though certainly as much is not to be expected of it as in conditions which are purely functional disturbances. *Insomnia* as an evidence of *cerebral anæmia and malnutrition* is often effectively removed by phosphorus. *Mania* and *melancholia* are thought by some to be benefited by it, and even *paralysis agitans* may thus be aided. In *neuralgias* of the asthenic type the remedy may sometimes be serviceable, and it is maintained that improvement may follow its use in *locomotor ataxia* and *spinal sclerosis*. No doubt can exist of its great value

in *impotence* of a functional nature, and the activity it possesses over the genital function is witnessed in the priapism which so often is a symptom of its toxic action. In *rickets* phosphorus is widely used and highly esteemed, and, though it would appear to the writer that calcium lactophosphate is its superior, both in theory and in practice, yet many place more dependence upon phosphorus for the cure of rickets than upon any other drug. In *osteomalacia* its value is similar. By some, phosphorus is thought effective in *pernicious anæmia* and in *pseudo-leucæmia*, but no great constancy of action can be expected of it in these conditions. In certain skin diseases phosphorus has been thought of benefit, notably in *chronic eczema*, *psoriasis*, *acne*, *lupus*, and *lupus erythematosus*. Indeed, the treatment of lupus erythematosus by phosphorus, as taught by Bulkley, is one of much excellence. This plan of treatment requires the use of full doses for a considerable time. Thompson's solution is preferred by Bulkley, because of its being less likely to cause gastric and hepatic disturbance than oily solutions or pills. Beginning with a dose of 15 drops, added to water quickly and quickly taken, three times a day and after eating, the dose is gradually increased until 40 or 45 drops are taken. Exceptionally the dose may even reach 60 drops. Careful observation is required throughout the course of treatment, and on the appearance of digestive disturbance the use of the drug is stopped and a remedy adapted to the digestive state—nitric acid, for example, or, if there is constipation, a pill of blue mass, colocynth, and ipecac—is substituted until the condition of the digestion becomes normal, when the use of phosphorus is resumed. With careful observation and the precautions described, the use of phosphorus may safely be continued for months, and from its use in lupus erythematosus much benefit may be expected.

So far as the use of phosphorus in general is concerned, it is certainly a remedy which is to be used with the utmost care, and, provided its use is to be long continued, frequent observation of the patient is necessary. It should seldom be long given in large doses, because of the danger of its causing fatty degeneration when so used and because, as a rule, small doses are as effective as large ones. It should not be given in diseases in which the lesions are acute and inflammatory, and, finally, it should under no circumstances be given in substance.

The preparations of phosphorus are not numerous. Phosphorated oil, *oleum phosphoratum* (U. S. Ph., Br. Ph.), is a 1-per-cent. solution of phosphorus in expressed oil of almond. Ether in small amount is added to the U. S. preparation to aid in preservation and to render the taste more agreeable. The dose is from 3 to 5 minims, and it may be administered either in emulsion or in a capsule. Pills of phosphorus, *pilulæ phosphori* (U. S. Ph.), and the phosphorus pill, *pilula phosphori* (Br. Ph.), are considerably employed. Each pill prepared according to the formula of the U. S. Ph. contains about $\frac{1}{100}$ of a grain of phosphorus, while the pill mass of the Br. Ph. contains $\frac{1}{30}$ of a grain of phosphorus in 3 grains. Of this the dose is from 1 to 2 grains, the equivalent of from $\frac{1}{90}$ to $\frac{1}{45}$ of a grain of phosphorus. Spirit of phosphorus, *spiritus phosphori* (U. S. Ph.), tincture of phosphorus, is a solution of phosphorus in absolute alcohol. Each drachm contains about $\frac{1}{15}$ of a grain of phosphorus. It is seldom employed save in making elixir of phosphorus, *elixir phosphori* (U. S. Ph.), which contains 210 parts of spirit of phosphorus, 2 of oil of anise, 550 of glycerin, and enough aromatic elixir to make 1,000 parts. The dose is from 20 to 40 minims. There is also employed a solution of phosphorus proposed by J. Ashburton Thompson, to which reference has already been made. This is composed of 1 grain of phosphorus dissolved in 5 fl. drachms of absolute alcohol by gentle heat and, added to it, a warmed mixture composed of $1\frac{1}{2}$ fl. oz. of glycerin, 2 fl. drachms of alcohol, and 40 minims of spirit of peppermint. Of this solution 1 fl. drachm will contain $\frac{1}{60}$ of a grain of phosphorus.

Phosphides are direct combinations of phosphorus with other elements or radicles. But one phosphide is in common use. This is zinc phosphide, *zinci phosphidum* (U. S. Ph.), a dark-gray powder or dark crystalline fragments of metallic lustre. It has an odour and a taste which resemble those of phosphorus. When exposed to the air it emits phosphorous vapour. It is insoluble in water and in alcohol. It is soluble in diluted hydrochloric or sulphuric acid, hydrogen phosphide being evolved. Its formula is Zn_3P_2. The physiological action and the therapeutic effects of zinc phosphide are those of phosphorus, for which drug it may be used as a substitute. The dose is $\frac{1}{10}$ of a grain.

Phosphites are salts of phosphorous acid. None are official.

Phosphoric acid is a name equally applicable to three acids—*orthophosphoric acid*, H_3PO_4, *pyrophosphoric acid*, $H_4P_2O_7$, and *metaphosphoric acid*, HPO_3. By general consent, it is the first of these which is meant when the unqualified term phosphoric acid is employed, and orthophosphoric acid alone is official.

Strong solutions of phosphoric acid are locally irritating and stimulating, but they are seldom applied, for they possess no advantage over other stimulant remedies. A 10-per-cent. solution in distilled water, however, is said to be an effective application to *chronic ulcers* when applied several times a day on lint. In weak solution phosphoric acid is frequently given internally as a *tonic* and *refrigerant*. That it is *stomachic* and aids digestion seems proved, but that it possesses any other remedial value is questionable, to say the least; it certainly has none of the systemic effects of phosphorus, and therefore for alterative action, save as alteration may follow improved digestion, it is inert. Notwithstanding this, phosphoric acid has been recommended for a variety of ailments, among them *hysteria*, *leucorrhœa*, *sexual debility*, *chronic bone diseases*, and *diabetes*. It has been thought to prevent *phosphaturia*, and indeed it may do so if indigestion is the cause, for in some cases of dys-

pepsia its curative power is considerable. The diluted acid is a desirable remedy in many varieties of *fever*, not because it exerts any curative influence upon the disease processes, as a rule, but because of its effect upon digestion and because, when added to water, it makes an agreeable refrigerant drink by virtue of its sour taste. Although the diluted acid is not actively irritant and is not astringent, its too liberal administration will cause digestive derangement similar in character to that which results from over-use of the vegetable acids. Several solutions of phosphoric acid are official. The strongest solution is known in this country as phosphoric acid, *acidum phosphoricum* (U. S. Ph.). This contains not less than 85 per cent. by weight of absolute orthophosphoric acid and not more than 15 per cent. of water. It is a colourless and odourless liquid of a strongly acid taste. This preparation is seldom used medicinally, though it may be given in doses of from 2 to 5 minims largely diluted. Concentrated phosphoric acid, *acidum phosphoricum concentratum* (Br. Ph.), in spite of what its name might suggest, is a weaker solution than the one previously mentioned. It contains "phosphoric acid, H_3PO_4, with 33·7 per cent. of water" (Br. Ph.). The dose is from 2 to 5 minims, given largely diluted. Another solution, yet weaker, is also known as phosphoric acid, *acidum phosphoricum* (Ger. Ph.). It contains 25 per cent. of the acid. The preparation which is generally employed is known as diluted phosphoric acid, *acidum phosphoricum dilutum* (U. S. Ph., Br. Ph.). The preparation of the U. S. Ph. contains 10 per cent. by weight of absolute orthophosphoric acid; the British preparation contains 13·8 per cent. by weight. The dose of either is from 10 to 30 minims, given freely diluted.

Under the name *acidum phosphoricum glaciale* (glacial phosphoric acid) there was formerly recognised by the U. S. Ph. a solid metaphosphoric acid, HPO_3. It is a white, uncrystallizable solid without odour, but of a very acid taste. It is deliquescent, soluble in water, and soluble also in alcohol. Glacial phosphoric acid was official solely for pharmaceutical purposes, and was dismissed because of its almost invariable impurity.

Phosphates are salts of the phosphoric acids, and particularly of orthophosphoric acid. The phosphates which are of the most importance medicinally are those of ammonium, calcium, iron, potassium, and sodium; though other phosphates have been employed, they are active rather because of their basic than of their acid constituents.

Ammonium phosphate, phosphate of ammonium (often improperly called phosphate of ammonia), *ammonii phosphas* (Br. Ph.), occurs in colourless, translucent crystals, without odour and of a cooling, saline taste. It is freely soluble in water, but insoluble in alcohol. When exposed to dry air it loses ammonia. Its formula is $(NH_4)_2HPO_4$. Though other ammonium phosphates are found in commerce, this salt alone is official. The dose is from 5 to 20 grains. It has been thought valuable in the *uric-acid condition*, the soluble ammonium urate and sodium phosphate being produced by its combination with sodium urate. It has also been recommended in *rheumatism*, and is employed at times as a *diaphoretic*. It is to be given dissolved in a moderate amount of water.

Calcium phosphate, calcii phosphas præcipitatus (U. S. Ph.), *calcii phosphas* (Br. Ph.), *calcium phosphoricum* (Ger. Ph.), precipitated calcium phosphate, phosphate of calcium, improperly called phosphate of lime, $Ca_3(PO_4)_2$, is a light, white, amorphous powder without odour or taste. It is insoluble in water and in alcohol, and is permanent in the air. It is dissolved by hydrochloric and nitric acids. Although calcium phosphate is insoluble in water, it is absorbed from the stomach in small amount because of the acids present in the gastric juice. There is no advantage in giving the salt in large doses, because the gastric acids are competent to dissolve and cause the absorption of small quantities only. The combination of calcium phosphate with lactic acid, however, is more soluble in water, and therefore the preparation known as syrup of calcium lactophosphate, *syrupus calcii lactophosphatis* (U. S. Ph.), is an admirable means of administering calcium phosphate. The importance of calcium phosphate in the animal economy is evident when it is known that there is no tissue of the body which does not normally contain it, and though it is most abundant in bone, it is equally essential to the health of the other structures also, for experiments have shown that animals fed upon food which lacks it will suffer with rhachitis or become wasted and enfeebled. Its medicinal employment therefore becomes rational in all conditions in which the quantity of the salt in the tissues is deficient. Of such conditions *rickets* and *osteomalacia* offer the best examples, though if it is true that in *tuberculosis* the phosphoric waste is increased, as shown by a larger quantity of earthy phosphates in the urine, without a correspondingly increased intake, *tuberculous conditions* are not less appropriately so treated. The treatment of rickets by the use of calcium phosphate is as effective as it is rational, and in osteomalacia as well as in *delayed union after fracture* the remedy is to be recommended. As to its value in tuberculosis, the proof is less convincing, though many esteem it highly in *chronic phthisis* and other tuberculous conditions. It would seem to be more generally effective, however, in the *debility of children and young people*, which suggests and may precede actual tuberculosis, than in the fully developed disease. The drug has been recommended also as an alterative in *late syphilitic manifestations*. The dose of calcium phosphate is from 10 to 30 grains. Syrup of calcium lactophosphate, *syrupus calcii lactophosphatis* (U. S. Ph.), is composed of 25 parts of precipitated calcium carbonate, 60 of lactic acid, 36 of phosphoric acid, 25 of orange-flower water, 700 of sugar, and a sufficient quantity of water to make 1,000 parts. The dose is from 2 to 4 fl. drachms. There is sometimes employed a non-official combination known as "chemical food," compound syrup of the phosphates, *syrupus phosphatum com-*

positus (Nat. Form.). This is composed of 256 grains of precipitated calcium carbonate, 128 grains of iron phosphate, 128 grains of ammonium phosphate, 32 grains of potassium bicarbonate, 32 grains of sodium bicarbonate, 1 Troy oz. of citric acid, 1 fl. oz. of glycerin, 2 fl. oz. of 50-per-cent. phosphoric acid, 2 fl. oz. of orange-flower water, 120 minims of tincture of cudbear, 8 Troy oz. of sugar, and enough water to make 16 fl. oz. The dose is from 1 to 2 fl. drachms.

Iron phosphate.—See under IRON.

Potassium phosphate, phosphate of potassium, K_2HPO_4, is a white, amorphous salt which is deliquescent upon exposure. Its use is similar to that of calcium phosphate, the salt being used as an alterative in various forms of *tuberculosis*. The dose is from 10 to 30 grains, given dissolved in water.

Sodium phosphate, phosphate of sodium, *sodii phosphas* (U. S. Ph., Br. Ph.), *natrium phosphoricum* (Ger. Ph.), sodium orthophosphate, $Na_2HPO_4 + 12H_2O$, is sometimes called phosphate of soda. It occurs in large, colourless crystals which are without odour, but of a cooling, saline taste. It is effloresecent in the air. It is soluble in water, but insoluble in alcohol. Sodium phosphate is a normal ingredient of the blood, and when administered in sufficient amount increases the alkalinity of that fluid. In small doses it is believed to possess *alterative* powers, and may be given in the same variety of cases in which calcium phosphate is useful. In moderate doses it is stimulant to the biliary function, and therefore may be administered in cases in which biliary production is insufficient. Among those in which it is most useful are *catarrhal jaundice*, *hepatic torpor*, *intestinal dyspepsia*, and *diarrhœa* with clay-coloured movements. Its power of promoting hepatic activity seems especially pronounced in children, and because of its not disagreeable taste the remedy is one which is well suited for use in the young. As to the value of sodium phosphate in *lithæmic conditions*, it seems evident that many patients are benefited by it, though many, too, seem but little relieved. In doses of 1 oz. sodium phosphate is laxative, but it is seldom used for this purpose. The drug is of much usefulness in preventing *biliary inspissation* and the formation of *biliary calculi*. Indeed, it is a more efficient remedy in this field than any other. It should be given for this purpose in moderate doses, and its use should be long continued. Upon calculi which are already formed the remedy has no influence. For children, the dose of sodium phosphate is from 3 to 10 grains, and it may advantageously be given to them in milk or other food. For adults, the usual dose is from 20 to 40 grains, though much larger doses may be given. For its constitutional effects it should be given after meals. (See also SODIUM PHOSPHATE.)

Sodium pyrophosphate, sodii pyrophosphas (U. S. Ph.), is prepared by heating sodium phosphate to redness, dissolving in water, filtering, and crystallizing. It appears as colourless, transparent crystals or as a crystalline powder. It has no odour, but a cooling, saline, and somewhat alkaline taste. It is permanent in cool air and effloresecent in warm air. It is soluble in water, but insoluble in alcohol. Its formula is $Na_4P_2O_7 + 10H_2O$. Though the action of sodium pyrophosphate is probably that of sodium phosphate, the salt is one which is little used medicinally. It is used in pharmacy, however, in making ferric pyrophosphate.

HENRY A. GRIFFIN.

PHOTOXYLIN, PHOTOXYLON, or *trinitrocellulose*, is a substance analogous to gun cotton, but made from wood pulp. A form of collodion made by dissolving it in a mixture of ether and alcohol has been employed for embedding objects of which sections are to be made for microscopical examination, also to some extent in surgery as a substitute for ordinary collodion.

PHULLUAH.—In the *Indian Medical Record* for Nov. 16, 1893, Mr. E. C. Beddell, W. M. O., says that this is an oily substance obtained from a plant that grows wild on the hills about Nani Tal. In its fresh state it resembles small white balls of about the size of areca nuts. When kept for some time in its liquid form it becomes of a dirty-brown colour. It is largely used among the tribes of the hills for the cure of *frostbites* and *chilblains*. Mr. Beddell has found the topical use of phulluah very beneficial in *rheumatism*, *sprains*, *sciatica*, and *chilblains*, and he is inclined to think that it would do good service in cases of *gout*, but as yet he has not had the opportunity of giving it a trial. Its action seems to him to be stimulant, emollient, powerfully anodyne, and antiseptic. It is best to heat the crude drug and then use it like an ordinary liniment by friction.

He relates the case of a Hindoo, forty-two years old, who in his youth had been a sepoy in a rajah's service and had received a sword wound and two bullet wounds. The scars of these wounds were still to be seen, but their situation could in no way account for a *paralysis* of which he was the subject. He had always enjoyed good health and had never had a head injury, a sunstroke, or a fit of any kind. His story of his paralysis was as follows: One night he had gone to sleep perfectly well, and the next morning been found insensible. On recovering consciousness, he had found himself in a hemiplegic condition. For fifty-four days thereafter he had been unable to walk and had had great difficulty in swallowing. He had gradually recovered to some extent. On inspection, Mr. Beddell found the man's right side paralyzed. His sensibility was partially affected; he could not tell accurately the situation of a part touched. There was a slight trace of sensation in the occipito-frontalis, the right masseter, the biceps, and the triceps, but it was quite lost in the right trapezius, the rectus, the vastus internus, and the hamstring muscles. The patient could lift his hand to an angle of about forty-five degrees. The usual routine treatment could not be carried out for want of proper medicines and appliances, and Mr. Beddell was therefore obliged to adopt such measures as were within the patient's means. His bowels were

cleared out with calomel, and it was ordered that a liniment of 8 oz. of phulluah, 2 oz. of oil of turpentine, and 4 oz. of rum should be rubbed into the affected parts three times a day. Continued friction with this liniment, together with steady massage, caused a remarkable improvement, and the patient was able to lift a weight of 3¾ lbs. with the paralyzed hand after a month of this treatment. Mr. Beddell is inclined to attribute the favourable result to phulluah and massage.

PHYSIOLOGICAL ACTION OF DRUGS.—The present scientific use of curative agents is a product of evolution not yet finished. It has developed from the pure empiricism of the ancients and the pseudo-science of the scholastics. The Egyptians, Romans, and Greeks had a materia medica which was based on experience: a patient received some drug or some form of drug which was known to have benefited some other patient with similar "surface-play of disease." The Greeks and Romans increased their list of drugs by placing votive tablets in the temples on which were inscribed the names of useful remedies with their indications. The Egyptians are said by Strabo to have displayed their sick ones in the open market place, that all who had suffered in similar manner might offer suggestions.

In the Middle Ages this empiricism was disregarded. Signatures largely took the place of tried remedies. These consisted of natural objects which were believed to have medicinal properties bestowed upon them by the stars. Thus, the hedge-turnip, having some resemblance to a swollen foot, was considered a certain cure for dropsy; the eyes on the peacock's tail, resembling a nipple and its areola, were considered specific for diseases of the breast in women. In the lungwort, or *pulmonaria*, a plant which looks faintly like a tuberculous lung, the scholastics believed they had an infallible cure for phthisis. Similar instances could be multiplied did not space forbid. So late as at the end of the eighteenth century the *London Pharmacopœia* contained crab's eggs, coral, earthworms, and the excrement of many vertebrate animals in its list of curative agents.

To the great Magendie is due the credit of having made the first scientific endeavour to use drugs in disease in accordance with their physiological action in health. His first experiment was on the *upas*, the active principle of which is strychnine, and his deductions were followed by clinical use of the alkaloid, derived, however, from the nux-vomica plant, since that was more accessible and cheaper than upas. In the same way, after the discovery of chloral, in 1830, by Liebig, it was regarded as a chemical curiosity until Liebreich, in 1860, showed, after experiment, its narcotic influence. Magendie was followed by a host of clinical and chemical experimenters who have raised the treatment of disease by drugs from the most absurd position to a comparatively rational basis; for, although at the present day we use some drugs empirically, such as quinine in malarial disease and mercury in syphilis, there exist good reasons and substantial indications for the administration of most of our remedial agents.

The effect of a drug introduced into the system is regarded as *direct*, *local*, or *primary*, or as *indirect*, *remote*, or *secondary*, according as its influence is exerted upon the site of application or upon some other organ or part through the nervous system or the circulation. The relation of effect to the *dose* varies with the quantity of the drug taken; and this relation changes in a manner depending upon the interaction of different parts of the body and upon the different effects the medicament exercises upon individual cells or tissues or organs. A very large and a very small quantity may thus produce the same symptoms, while an average dose may cause a different effect. Lauder Brunton (*Text-book of Pharmacology, Therapeutics, and Materia Medica*, Philadelphia, 1885) states that the quantity entering the system or coming into contact with its tissues must depend upon the quantity actually given, its relation to the bodily weight, its rapidity of absorption and excretion, the rate of absorption by the tissues, and the condition of the circulation in various parts of the body which determine the quantity of the drug carried to each. The dose of a drug, therefore, varies in proportion to the amount already in the system. If a drug is not rapidly excreted or dissolves very slowly, as strychnine does, it may remain in the body for a considerable time and finally show the effect of an accumulated dose. This is known as *cumulative action*. Physiological experiment has determined that bodily weight and dose are proportionate to each other. Children, for this reason, receive in practice smaller doses than adults.

It has been demonstrated, likewise by experiment, that in the administration of drugs the quickest possible effect is obtained by their injection into a blood-vessel; that the subcutaneous introduction of a drug offers the next most rapid transfer of effect; that a medicament administered by the mouth requires for the exertion of the same influence a larger dose; and that drugs introduced into the rectum require to be used in still larger quantities and for a greater length of time to produce their effect. Absorption after subcutaneous injection is quickest in the most vascular areas, which are, in order of rapidity of assimilation, the temples, the breast, and the inner surfaces of the arms and legs. The serous membranes absorb more quickly than the intercellular tissues, and these more rapidly than mucous membranes.

The human body is so complex and the inter-relations of its parts are so difficult to comprehend that it is little wonder that the physiological action of drugs in health is masked by disease. The well-known excitement following the administration of opium in delirium, for instance, is a good example. Other influences modify the effects of drugs when given in the determined physiological dose. Thus, drugs in *soluble form* exert their influence more quickly than solid substances; an *empty*

stomach facilitates their introduction into the system, but they affect the viscus locally as well; the *surrounding temperature* and the *temperature of the individual* modify the action of a drug; a warm *climate* seems to increase narcotic influence; the *time of day* determines modifications which depend upon lowered or heightened vitality. *Tolerance*, *idiosyncrasy*, and *habit* are powerful factors in the determination of doses; quantities of opium and arsenic, for example, may be taken by persons addicted to these drugs which would speedily prove poisonous to a stranger to them. *Emotions* play a considerable rôle in affecting the action of drugs; the firm assurance that a substance will exert a certain influence may induce the desired result, though the dose may be a minimal physiological one or though the drug may not be given at all.

To determine the effects of drugs upon the human system, experiments are carried out in various ways. Some animal of simpler constitution is chosen and deductions are made by analogy, allowing for differences in bodily weight; or a drug is applied to some part of a more complex animal body separated from the rest, being prevented from reaching other parts of the body at the same time; or artificial changes are produced in the relations of the various parts of the body, as by dividing the pneumogastric nerves, and the effect of drugs is noted on isolated organs or parts of the body (Lauder Brunton, *loc. cit.*). By subsequent careful experimentation upon the human body, eliminating such errors as are manifest by the differences in anatomical structure, exact physiological knowledge is easily attained.—Samuel M. Brickner.

PHYSOSTIGMA (U. S. Ph.), *physostigmatis semen* (Br. Ph.), the ordeal bean of Calabar, has been considered, so far as its therapeutical properties are concerned, in the article on Eserine, which is another name for *physostigmine*, and in the article on Motor depressants (vol. i, page 644). It may be added here that Dr. Giovanni (*Il Morgagni*, 1895, No. 7; *Dtsch. Med.-Ztg.*, November 18, 1895) reports the successful treatment of three cases of *hæmaturia* with Calabar bean. One was a case of so-called essential hæmaturia in which six months of treatment had been ineffectual. Extract of physostigma was prescribed, and in a few days the hæmaturia ceased, to come on again when the use of the remedy was continued, and to subside definitively on its resumption. In the two other cases the hæmaturia accompanied cancer of the kidney in one and Pott's disease in the other; in both instances it yielded to the remedy. The dose of physostigma in powder is from 1 to 4 grains; that of the extract, *extractum physostigmatis* (U. S. Ph., Br. Ph.), is from $\frac{1}{6}$ to $\frac{1}{4}$ of a grain; that of the tincture, *tinctura physostigmatis* (U. S. Ph.), is from 20 to 40 minims.

PHYSOSTIGMINE, *physostigmina* (Br. Ph.), is the same as eserine (*q. v.*). The official discs of physostigmine, *lamellæ physostigminæ* (Br. Ph.), contain each about $\frac{1}{1000}$ of a grain of the alkaloid. The sulphate, *physostigminæ sulphas* (U. S. Ph.), *physostigminum sulfuricum* (Ger. Ph.), and the salicylate, *physostigminum salicylicum* (Ger. Ph.), are also in use (see under Eserine).

PHYTOLACCA, or *poke*.—Both the root and the berries of *Phytolacca decandra* are official in the U. S. Ph., being denominated respectively *phytolaccæ radix* and *phytolaccæ fructus*. The root is the more active. The leaves of the plant possess the same properties, but to a much less marked degree. It is a *narcotic emeto-cathartic*, and the accidental ingestion of the berries has been followed by fatal results, death being due usually to paralysis of the respiration. Its chief use in medicine is in the treatment of *mammitis*, over which it appears to have more effect than any other drug we possess. It should be applied in the shape of the non-official solid extract spread upon cloth which must cover the entire breast save the nipple, which, it is hardly necessary to state, must be thoroughly cleansed before an infant is allowed to suck. At the same time it is recommended to administer it internally. It is maintained that in *inflammation of the lymphatic glands* suppuration may be prevented by its application to them in the same manner as to the breasts. *Varicose* and other *ulcers* of the leg and *chronic eczema* are said to be benefited by a similar method of application, but there is considerable doubt as to whether there is any specific effect in this direction upon the part of the phytolacca, and whether in the reported cures the use of any simple ointment would not have been as effectual. In *chronic rheumatism* it has long been held to be of value, and in obstinate cases it is worthy of a trial. Also *alterative* properties are ascribed to it, and *granular conjunctivitis* is said to be cured by it, but the evidence in this latter case is very shadowy. Although it is emetic, there is nothing to recommend its selection in preference to the more easily found and less depressing agents. The U. S. Ph. orders a fluid extract, *extractum phytolaccæ radicis fluidum*, the dose of which is from 1 to 5 minims.

[Dr. Goodman (*S. Carolina Med. Jour.*, April 20, 1895; *Therap. Gaz.*, August, 1895) says that the green leaves of the plant possess a property which alone would entitle it to rank among the most valuable remedies of the materia medica—that of destroying *epithelioma*. The method of using the remedy is to bruise the green leaves to a pulpy mass; collect the expressed juice in a shallow receptacle, such as a plate; allow it to evaporate to a thick, pasty consistence; spread a portion of this on a piece of silk or other suitable cloth, and apply to the morbid growth. The plaster should be removed and the part washed twice daily. The remedy causes severe pain. It has a selective action for the morbid tissue; follows out all the irregularities of the epithelioma; causes, as it were, its liquefaction and removal, and then acts as a cicatrizant for the open sore. As soon as all the morbid tissue is destroyed, a bed of cicatricial tissue begins to spread from the periphery, and as this occurs the plaster should

be cut smaller each day, so as to conform to the size and shape of the surface to be covered by it. Under this treatment Dr. Goodman has seen large epitheliomatous masses destroyed in a few weeks, and nothing but a faint scar left at the place occupied by the growth. In no case was there a recurrence at the original site. Unlike other remedies, he says, it may be used fearlessly, does not endanger the patient, combines within itself a caustic action and a healing property, and requires to be used in the same manner from beginning to end.

The alkaloid *phytolaccine* is a cardiac and respiratory poison; its antagonist is atropine (see vol. i, p. 88).]—Russell H. Nevins.

PICHI is the Chilean name for *Fabiana imbricata*, a shrub or small tree of South America. It belongs to the order *Solanaceæ*, the suborder *Curvembriæ*, and the tribe *Nicotianeæ*. It is usually found growing in dry, sandy places, especially on the tops of the hills, where there is little other vegetation. It reaches a height of from 15 to 18 feet. The larger branches are covered with a thin, smoothish, somewhat warty, brownish-gray bark, which adheres firmly to the yellowish, tough wood. The upper twigs are crowded together, forming plumelike sprays, and are covered with bluish or greenish-gray leaves, which are broadly ovate, blunt-pointed, thick, sessile, closely imbricated, and about a line in length. All the tender parts are covered with a resinous coating, which is a striking peculiarity of the plant. The same resin exists also to some extent in the wood, especially of the smaller branches, and abundantly in the bark. In the second year each of the terminal branchlets bears a solitary flower having a tubular white and purplish corolla from ½ to ¾ of an inch long and of four times the length of the calyx. The fruit is a two-celled and two-valved capsule containing usually four flattened, oblong, brown seeds with a roughened crustaceous testa.

The leaves and twigs yield a crystalline fluorescent substance that resembles æsculin, and is supposed to be a glucoside, together with paviin and fraxin, besides a resin and an essential oil. According to Lyons, there is also a bitter alkaloid named by him *fabianine*, which is said to form crystalline salts, but other observers have failed to identify this substance. It is believed that the active principles of the plant reside in the fluorescent glucoside as well as in the resin and the essential oil.

The drug was first brought into notice in this country by Dr. Henry H. Rusby (*Therap. Gaz.*, December, 1885), who obtained his information originally from Dr. Ramirez, of Valparaiso. In Chile the drug had been much employed in the treatment of *urinary diseases*, particularly when there was *irritation from the presence of gravel or calculi*. It is said to act as a sedative to the irritable mucous membrane of the urinary tract, modifying the secretions and subduing the pain. It is believed also that it aids in the expulsion of calculi. There have been numerous reports of its successful employment in this class of affections. According to Limousin (*Bull. et mém. de la Soc. de thérap.*, April 14, 1886), it is probable that the resin disintegrates the calculi by dissolving the mucus that keeps the particles together, thus facilitating their expulsion, but it is not probable that there is any solvent action on the calculus itself.

In *cystitis*, both chronic and acute, whether accompanied or not with the arthritic diathesis, its successful employment following the failure of other remedies has often been reported. In *prostato-cystitis following gonorrhœa* it has also been used with most favourable results.

Mr. Reginald Harrison (*Bost. Med. and Surg. Jour.*; *Med. Age*, 1891, p. 154) reports that he "has used pichi during four years in the form of a fluid extract, in drachm doses, with considerable benefit. In *renal colic* and the passing of *calculi* through the kidneys and along the ureters, attended with *hæmaturia*, though not exercising any solvent power, it seems, by its action on the tissues, in some way to favour the escape of the stone, and thus suppress bleeding; it has been found useful also in the hæmorrhage which frequently accompanies *cancer of the bladder*. The sedative action of the drug on the mucous membrane of the bladder has proved beneficial in many instances of irritability connected with a *large prostate*. After the bladder has been properly cleansed by irrigation and disinfected it has been frequently found that the calls to urinate were far less urgent when the pichi was used."

Where organic disease of the kidneys exists the drug is generally regarded as contra-indicated, as other terebinthinate remedies are. But where *renal hæmorrhage* is a marked symptom, even though organic disease is present, it has been maintained that the drug exerts a beneficial effect.

In *hepatic diseases* the drug is said to have been used with benefit, the effect being due probably either to its action on the stomach as a bitter tonic, or to the diuretic action which it possesses, rather than to any direct cholagogue effect.

Pichi is usually administered in the form of a fluid extract, of which the dose is from 10 to 40 minims. It is not miscible with water unless the solution is made alkaline. The best vehicle is glycerin. A solid extract and a powdered extract are also prepared, which may be given in doses of from 2 to 10 grains. Limousin recommends a decoction of the pichi wood. An ounce of the coarsely powdered twigs is boiled in 2 pints of water, and this quantity is taken, divided into four equal portions, during the twenty-four hours. Salines should not be combined with pichi, as they cause the separation of the resin in dense curds.

Edward Bennet Bronson.

PICRÆNA EXCELSA.—See Quassia.

PICRIC ACID, or *trinitrophenol*, is formed by the action of nitric acid on phenol, benzoin, silk, indigo, salicylic acid, leather, and many other substances. Its formula is $C_6H_2(No_2)_3OH$ $=C_6(No_2,H,No_2H,No_2OH)$. It occurs in yellow, shining crystals or scales, fuses at 252·5° F., and explodes if subjected to higher heat. The

salts of the acid explode on percussion. Picric acid is freely soluble in water, the solution having a strong yellow colour. The acid has an exceedingly bitter taste.

Taken internally, picric acid stains the skin and visible mucous membrane a decided yellow, and the urine shows distinct traces of the acid. Its action in large doses is toxic. Erb has shown that by it the red corpuscles of the blood are destroyed and a leucocytosis is produced. The colour of the blood becomes dirty brown (*Die Pikrinsäure*, Würzburg, 1865).

Though there is practically no therapeutic value in the internal use of picric acid, it has been recommended, in the form of ammonium picrate, in the treatment of *malarial diseases*. Thus, Clark, an army surgeon of East India, alleged it to be so valuable in the treatment of thousands of cases of malarial fever that he no longer employed quinine (*Lancet*, 1887, i). In the hands of others it has not been so efficient. As a remedy for *trichiniasis* picric acid at one time was in favour. Direct experiment, however, has proved that it is powerless in this infection. It is equally useless as an *anthelminthic*, and there is no evidence that it possesses the *tonic properties* which have been alleged for it.

Locally, picric acid has been employed by Chéron as a caustic and antiseptic after curetting the uterus for *fungous endometritis* (cited in *Med. News*, June 11, 1887, p. 659). For this purpose he recommends a solution of 1 to 300 in water. In a solution of 6 parts to 1,000 of water it has been praised in the treatment of *eczema*, *erysipelas*, and *lymphangeitis* (*Lancet*, April 6, 1889, p. 702). In the same proportion it has been used for *fissured nipples*, and as a local application in *impetiginous eczema* after removal of the crusts by oil.

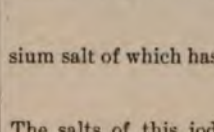
[The *Medical Record* for November 23, 1895, credits the *Medical Times and Hospital Gazette* with the following: "French surgeons have recently been using a solution of picric acid for the first treatment of *burns;* and it has been found that the pain which is caused by the burning of the skin can be almost immediately alleviated, or altogether removed, by painting the affected surface with a strong solution of picric acid. It is stated that the remedy has proved to be quite harmless, and that the yellow stains which are caused by its application can be easily washed out with boric acid. The general verdict of those who have employed the remedy is that it has greatly lessened suffering, and has therefore probably saved life, while it would appear that even severe cases thus treated have recovered more speedily and completely than would have been the case under other forms of treatment. It would therefore be well, presuming that experience of the remedy in this country gives identical results, if the medical officers of factories or workshops, where accidents like burning or scalding are common occurrences, would direct that solutions of the acid should be kept at hand, and explain the method of its application to the workers."]

In an aqueous solution of 15 grains to an ounce of water, picric acid is used for the *detection of albumin in urine*. It is a delicate test, but as mucin, peptones, and potassium salts are also precipitated by picric acid, it is not absolutely reliable. As a test for sugar in urine, picric acid occupies an inferior place.

In pathological and histological work, picric acid is used for fixing and staining specimens, either in bulk or after section. It is also employed in combination for the decalcification of bones and teeth. For these purposes a saturated aqueous solution is prepared.

SAMUEL M. BRICKNER.

PICROL.—Darzens and Dubois (*Répert. de pharm.*, iv; *Pharm. Jour. and Trans.*, October 29, 1892) have given this name to an iodine derivative of resorcinmonosulphonic acid the potassium salt of which has the formula



The salts of this iodized acid are said to be powerfully *antiseptic*, but not very poisonous. The potassium salt is soluble in 5 parts of water, and is soluble also in alcohol, in glycerin, in ether, and in alkalies. It contains 52 per cent. of iodine. Until more is known of its action, picrol should be used with caution.

PICROTOXIN, *picrotoxinum* (U. S. Ph.), is a neutral principle obtained from the seed of *Anamirta paniculata*, a climbing shrub growing in India. It occurs in colourless, shining crystals or in a crystalline powder without odour but of a very bitter taste. It is permanent in the air, and, though only moderately soluble in cold water, is more soluble in boiling water and freely soluble in alcohol. It is soluble also in alkaline solutions and in acids. Its formula is $C_{30}H_{34}O_{13}$. Picrotoxin, because of its bitterness, is *stomachic*, and it is said to be added to malt liquors that it may increase both their bitterness and their intoxicating properties. When taken in small doses, picrotoxin causes increase of the saliva and probably of the other digestive juices as well; moreover, it stimulates peristalsis, and by its use the movements are rendered large and soft. The drug is absorbed not only from the stomach but also from denuded areas, and therefore its external application should be cautious. It is eliminated chiefly by the kidneys.

Picrotoxin, when given in sufficient amount, is a violent poison, producing grave nervous disturbances. In poisoning, the main symptoms are general convulsions, which are both tonic and clonic. In fact, the combination of clonic and tonic attacks is thought to be highly characteristic of poisoning by picrotoxin. It is said, too, that the clonic seizures often appear highly co-ordinated, and that various perfected movements are gone through with, such as the motions of walking and eating. During the convulsive periods the heart's action is rapid, but in the intervals the pulse is slow and the arterial tension is raised. During the convulsions the breathing, too, is accelerated, but between them it is said to be slow and shallow. At times there is spasmodic

arrest of respiration. In some cases the pupils are at first contracted and subsequently dilated, but these phenomena are not constant. The mental condition varies; frequently it is a dull sort of intoxication. Dizziness, tremblings, inco-ordination, and stupor are observed, and finally coma. The sequence of the phenomena of picrotoxin poisoning, the tonic convulsion followed by the clonic seizure and this by the period of exhaustion, stupor, and even coma, bears some resemblance to the usual epileptic attack. In many cases of poisoning vomiting is a symptom. As to the causation of these phenomena opinions differ, but it seems probable that the convulsive seizures are due to stimulation of the motor centres of the medulla oblongata and the spinal cord. Reflex activity is said to be diminished after the convulsive attacks, and this has been attributed to exhaustion of the motor centres, for from the administration of small doses there is observed increase of reflex action from stimulation of these centres. The action of picrotoxin to increase blood-pressure is due to direct stimulation of the vaso-motor centres, while its action to cause slowing of the heart is thought to be due both to stimulation of the inhibitory nerves and to a direct action upon the heart muscle. In fatal cases the heart stops in diastole. In cases of poisoning by picrotoxin the stomach should be emptied if the drug has been taken by the mouth and the case is seen sufficiently early. Further than this the treatment is symptomatic and supporting.

The dangerous quality of picrotoxin is out of all proportion to its usefulness, and the remedy, though recommended for various morbid conditions, is neither popular nor invaluable. Its chief employment is for the relief of *colliquative sweating*, especially the *night sweating of tuberculosis*, but, though it is certainly efficient in many cases, it is not more so than many other remedies, although the anthidrotic effect from picrotoxin is said to last for several days, and therefore to make frequent administration unnecessary. In *epilepsy*, in *chorea*, and in *paralysis agitans* picrotoxin has been thought valuable, but it is seldom employed for their relief. It has also been recommended in various *paralyses*, notably in those of the sphincters. Picrotoxin is *antiparasitic*, and has been applied in ointment for the relief of *various parasitic diseases of the skin*. Such a use of the remedy is not to be recommended, for it is no more efficient than many another, and the danger of its absorption is great. The dose of picrotoxin is from $\frac{1}{100}$ to $\frac{1}{30}$ of a grain.

HENRY A. GRIFFIN.

PILEA PUMILA.—See URTICA PUMILA.

PILIGANINE.—See under LYCOPODIUM.

PILLS.—Pills are small round or ovoid masses composed of one or more medicinal agents and usually containing some binding substance to prevent them from becoming brittle or losing their shape. They are one of the oldest forms in which medicines have been administered, and, if carefully prepared, constitute one of the most convenient for the administration of medicines by individual doses.

Properly made, pills should be as small as the nature and amount of their constituents will permit, should be sufficiently cohesive to admit of free handling without crumbling to pieces, and should be readily dissolved or disintegrated in the contents of the stomach or of the intestines, according to their destination.

Pills are either coated or uncoated. As a rule, uncoated pills are the surest to produce the desired effects if they are to act from the stomach. Nevertheless, the art of coating pills has now attained to such perfection, and most of the coatings used are so readily soluble, that the objections formerly raised against all coatings are no longer justified. The manufacture of pills is now carried on by many houses on a very large scale, and the public as well as the medical profession have become so well acquainted with the peculiar features or merits of the various kinds found in the market (sugar-coated, gelatin-coated, "soluble," "friable," etc.) that the larger proportion of the pills dispensed by the apothecary is the product of the large manufacturers.

To prepare a proper pill-mass it is necessary to possess a knowledge of the nature and properties of the ingredients. Unless it is specially intended otherwise (as in *pilula ferri carbonatis*), the mixture must be made so that none of the ingredients will decompose any of the others or render the production of a well-shaped, cohesive, and soluble pill difficult or impossible. Except in the case of certain extracts or standard pill-masses (such as *massa copaibæ* and *massa hydrargyri*), which may be formed into pills without the intervention of a supporting agent, most pills require, in addition to the medicinal constituent, a binding substance, called excipient, such as honey, molasses, syrup, mucilage, glycerin, some aqueous or alcoholic extract, or the like. The choice of the proper excipient is often left to the discretion of the dispenser, the prescriber having omitted it. As a rule, it is a safer plan for the physician to leave the choice of the excipient for pills not already containing some tenacious ingredient to the pharmacist, unless the physician himself is versed in the apothecary's art.

The first point to be observed in making a pill-mass is to see that all the ingredients, with the exception of the excipient, where this may for the time being be kept out, are in the finest possible subdivision and thoroughly mixed. This is particularly necessary in the case of pills which are to contain minute doses of potent remedies, such as $\frac{1}{500}$ of a grain of aconitine, $\frac{1}{60}$ of a grain of atropine, etc. Next, the excipient is to be incorporated, first with a small portion of the mass, then gradually with the remainder, and the whole systematically worked about, folded and refolded over itself, again worked about, etc., until the mass is perfectly uniform and of the proper plasticity. It is then rolled out and cut into the required number of pieces, and the latter are given their proper shape either by the pill machine or with the fingers.

Soft extracts and semi-fluid or deliquescent

ingredients usually require the addition of a small amount of a fibrous powder (such as powdered licorice root, powdered gentian, powdered marsh mallow, etc.) to give to the pill the requisite firmness and stability. Moreover, if a pill contains deliquescent substances, it is best to give it some coating. Indeed, when such pills are to be kept, a coating becomes indispensable.

Inorganic salts containing water of crystallization should first be dried before they are made into pills.

If the constituents of a pill consist of non-adhesive powders, one of the above-mentioned excipients should be used. Neither gum arabic nor tragacanth, however, is a good pill excipient unless used in very small quantity, since they are apt to render the pills very hard and often nearly insoluble. If either of these is to be used, a little glycerin should be added.

Among the most generally applicable excipients the following two deserve special mention:

Upham's Excipient.

Powdered acacia	1 drachm;
Powdered tragacanth	2 drachms;
Glucose (white)	5 drachms;
Glycerin	3 oz.

Remington's Excipient.

Powdered acacia	90 grains;
Benzoic acid	1 grain;
Glucose (white)	4 av. oz;
Glycerin	1 av. oz.

Coating of Pills.—Originally, pills were coated to mask their taste or odour, or to prevent them from change by exposure to air. Nowadays it is customary, on the part of manufacturers, to coat *all* pills, not because all of them require it (opium or quinine pills will keep uncoated just as well), but to put upon them, as it were, the trade-mark of their manufacture. So long as the coating is readily soluble, no objection can be made to this practice.

The *silvering* and *gilding of pills* have almost gone out of date. The coating is of no practical value, since it is but rarely so applied as to form an efficient protection to the constituents.

Pills containing readily oxidizable matters, such as phosphorus, phosphides, and ferrous iodide or bromide, or deliquescent salts, require some kind of coating. One of the most efficient is a coat of balsam of Tolu or benzoin or mastic. After the pills have been formed they are placed in a flat-bottomed capsule into which a little of an ethereal solution of balsam of Tolu is poured. After being rotated in this for some time they are removed and allowed to dry. If necessary, the process may be repeated. The ethereal solution is directed by the Pharmacopœia to be prepared from 10 parts of balsam of Tolu and 15 parts of ether.

Sugar-coating, which is the method least to be recommended, can be carried on successfully only on a large scale.

Gelatin-coating can be carried on easily on any scale. The coating solution is prepared by dissolving 4 parts of the best gelatin (French, "gold brand") and 1 part of the clearest and purest gum arabic (sometimes together with about ¼ of a part of boric acid) in 40 parts of water by the aid of heat. On cooling, this liquid becomes a jelly, and may be used in portions as wanted.

When the pills have been formed, they must be dried on the outside and freed from any adhering powder. They are now picked up on the ends of needles and dipped into the melted gelatin solution. After being withdrawn, they are held for a moment to allow the superfluous gelatin to collect in the form of a drop which is removed by touching the surface of the gelatin solution, and the frame in which the pins are fastened is rotated so as to cause the coating to distribute itself evenly. When the coating is set, the small hole made by the pin is coated separately. On a large scale the coating is performed on machines which act almost entirely automatically.

Keratin or *Salol Coating.*—Sometimes it is intended that a pill shall pass through the stomach unaltered, reserving its action until it arrives in the duodenum. In this case it is coated either with keratin or with salol. As to keratin, see under this title. To coat pills with salol, prepare them as for gelatin coating, impale them on pins, and dip them into salol melted on a water-bath in a small, deep capsule. The coating hardens almost as soon as the pills are removed from the melted mass. The pin-holes are afterward closed by applying a little of the salol with a brush or rod. A salol coating may be applied over a gelatin coating, thus rendering it possible to use ready-made pills for this purpose.—CHARLES RICE.

PILOCARPINE.—This alkaloid, $C_{11}H_{16}N_2O_2$, was considered to some extent in the article on JABORANDI, which the reader may consult in connection with this one. The hydrochloride, *pilocarpinæ hydrochloras* (U. S. Ph.), *pilocarpinum hydrochloricum* (Ger. Ph.), and the nitrate, *pilocarpinæ nitras* (Br. Ph.), are official.

A Hungarian physician, Dr. Sziklai, is a strenuous advocate of the use of pilocarpine as a preventive of *diphtheria, pseudo-diphtheritic affections*, and *croup*, also in the treatment of all stages of *croupous pneumonia*. He urges the employment of pilocarpine more particularly in families where one case of diphtheria has already appeared. He believes that it may actually prevent the formation of false membranes. As a safe prophylactic he advises a 1-per-cent. solution to be given in 10-drop doses three times a day. For infants less than a year old half this quantity is sufficient. He has never observed any untoward effects from pilocarpine, and believes its use in diphtheria will yet come to be regarded in the same way that quinine is looked upon in malarial disease. (*Med. Record*, January 18, 1896.)

Sziklai's belief in the prophylactic and curative powers of pilocarpine has led him to the length of saying that it exerts a mechanical effect by the profuse secretion which it gives rise to, so that undermining, loosening, and separation of the croupous or diphtheritic

membrane result; and in addition a chemical effect whereby the transudate is deprived of its fibrin, so that there can be no further formation of false membrane. He says, furthermore (cited by Glass, *Ctrlbl. f. d. ges. Therap.*, October, 1895; *Therap. Gaz.*, November, 1895), that pilocarpine is a specific against croup in the broadest sense of the word, and therefore against all croupous diseases—*conjunctivitis, rhinitis, croupous pneumonia*, etc.; that its action is immediate, so that recovery from pneumonia occurs in two or three days; that not only is the duration of the disease considerably shortened by it, but also the mortality brought down to nothing; that in appropriate cases, if administered early enough, the remedy has a preventive action; and that it can be given in twice the official dose without any injurious results whatever.

Glass has tested this treatment in eighteen cases of pneumonia, using the remedy only in the developed and undoubted cases. Following the example of Sziklai, he added the pilocarpine to an infusion of ipecac, and in cases which required energetic treatment pilocarpine was given subcutaneously. In part of the cases an infusion of jaborandi leaves was employed, without his being able to detect any essential difference in the action of the two remedies. As a rule, he combined with this medication corresponding doses of strophanthus or digitalis. He began with single doses of from $\frac{1}{7}$ to $\frac{1}{4}$ of a grain of pilocarpine, and in no case exceeded the maximum dose. Usually in half an hour or more after the administration of the remedy there occurred profuse salivation, then great perspiration, redness of the face, a full pulse, with slight increase in its frequency, lively action of the heart, and expectoration of a slightly hæmorrhagic, foamy material. Examination of the lungs showed numerous small and middle-sized moist râles throughout the whole extent of both lungs, although before the employment of pilocarpine no catarrhal symptoms of any kind had been detected.

After analyzing his own cases at considerable length, Glass concludes that the administration of pilocarpine in doses of from $\frac{1}{7}$ to $\frac{1}{4}$ of a grain, which induce noticeable symptoms of collapse, results in some cases in a strikingly rapid extension of the pneumonic process. A pronounced cure in acute pneumonias he did not observe. On these grounds, he thinks, the employment of the remedy in such cases of pneumonia does not seem justified. Especially, he remarks, is this the case in private practice, where uninterrupted observation of patients can not be carried out. In addition, he concludes that in delayed resolution the remedy may, in the doses above named, given two or three times a day, be administered for five or six days in succession without decided bad symptoms being produced by it. In this stage the remedy may effect a pretty rapid solution, yet it fails in some cases. Heart weakness here also, he says, contra-indicates the employment of pilocarpine.

On the other hand, in *pneumonia due to influenza*, Poulet (*Nouv. rem.*, November 24, 1895; *Brit. Med. Jour.*, December 28, 1895 [*Epitome*]) has met with very good results from the use of pilocarpine. During an epidemic which prevailed in the neighbourhood of Plancher-les-Mines in February, 1895, and attacked more than 1,000 out of a population of from 3,000 to 4,000, he treated 108 cases of *influenza* in which *pneumonia* and *broncho-pneumonia* were formidable complications with pilocarpine, with only four deaths. He gave the drug in daily amounts of $\frac{1}{4}$ of a grain, except in the case of children, to whom a proportionally smaller amount was given. The treatment generally lasted two days, in only a few cases three days. It was efficient in several cases of persons over seventy years of age. It was far less effective, however, in pneumonia complicating whooping-cough in children.

Pilocarpine phenylhydroxide, $C_{11}H_{16}N_2O_2$. $OH.C_6H_5$, which, according to Dr. Henry A. Mott, consists of 53·92 per cent. of pilocarpine and 46·08 per cent. of phenol, forms 0·0188 per cent. of Dr. Cyrus Edson's "aseptolin," which has lately been vaunted as a remedy for *tuberculosis*, but has not yet been sufficiently tested in practice to admit of a judgment being rendered as to its efficacy. (*Med. Record*, February 8, 1896.)

In the article on JABORANDI the use of that drug in *uræmia* is treated of. It may be added here that H. Mollière has recently called attention to the use of external applications of pilocarpine in the treatment of *acute* and *chronic nephritis* (*Ann. d. mal. d. organ. génito-urin.*, January, 1895; *N. Y. Med. Jour.*, February 9, 1895). He has used frictions, especially of the trunk, with an ointment composed of 3 oz. of white vaseline and from $\frac{1}{2}$ to $1\frac{1}{2}$ grain of pilocarpine nitrate. A very large dose of the remedy, he says, causes disagreeable cutaneous eruptions, which may make it necessary to interrupt the treatment. The region is covered with a thick layer of cotton wool and a piece of waxed linen, which is not to be taken off until the wool is completely wet with perspiration, when it is replaced at the end of a few hours. In patients who are subjected to a milk diet, as well as in those who take other forms of nourishment, he says, the results are very nearly the same: a rapid recovery in acute nephritis and a marked amelioration in the chronic form.

M. Mollière calls attention to the sudorific action of pilocarpine, which is manifested by a continued abundant sweat, and he adds that a concomitant diuresis is accomplished through the medium of the nervous system. In this way, he says, medicaments which act directly on the kidneys after being absorbed by the stomach, which they soon irritate and disorder, may be avoided. External applications of pilocarpine, says M. Mollière, do not directly influence either the kidneys or the stomach, and the revulsive and derivative action on the skin facilitates the elimination of the toxines and at the same time relieves the congestion of the kidneys. Furthermore, the diuretic action of pilocarpine is added to that of the milk, and, by the sweating it provokes, the

drug moderates the exaggerated action, if there is any, which may end by irritating the kidney itself. In the beginning of convalescence, he says, when the œdema has disappeared and the albuminuria diminished, it is well to have this indirect diuretic action. The physiological action of pilocarpine applied by friction, says M. Mollière, seems to be purely local; the medicament is not absorbed, and it is impossible to find any trace of it in the urine. With regard to diuresis, it may be explained by the effects which are obtained in external applications of certain other alkaloids. In the same manner that sparteine, when applied to the skin, produces a lowering of the central temperature, so pilocarpine may give rise to a medullary reflex causing dilatation of the blood-vessels of the kidney.

In a subsequent communication (*Concours méd.*) M. Mollière says that the pilocarpine treatment should not be suspended except in cases where the patients are too weak. Then it is to be interrupted for forty-eight hours, after which it may be continued, but with an ointment containing only one half the original quantity of nitrate of pilocarpine. With regard to the quantity of ointment to be used at each application, it varies, according to the size of the patient, from 300 to 600 grains. The amount indicated in the formula generally suffices for three or four applications.

Pilocarpine has been employed with some success in the treatment of *labyrinthine vertigo*, or *Ménière's disease*.

Three cases were treated by Labit in Moure's clinic in Bordeaux (*Rev. de laryngol., d'otol. et de rhin.*, September 1, 1894; *Brit. Med. Jour.*, September 29, 1894 [Epitome]). They occurred in a governess aged sixty-eight, a stoker aged forty-nine, and a female cook aged twenty-eight. The first had previously been affected with sclerotic catarrh of both middle ears: the others were quite free from any aural disease of the kind, but were, from the nature of their occupations, exposed to extreme heat. In all there were the typical symptoms—noises, vertigo, nausea or vomiting, and deafness to osseous as well as to aerial sound vibrations. In the second case one ear only was affected. The first patient received fifteen injections of from $\frac{1}{20}$ to $\frac{1}{3}$ of a grain, the second thirteen of from $\frac{1}{12}$ to $\frac{1}{3}$ of a grain, and the third eight of from $\frac{1}{20}$ to $\frac{1}{4}$ of a grain, continued and increased. In all the cases the vertigo disappeared, the noises diminished, and the hearing was to a certain extent restored. The writer compares the absorption produced to that observed in pleural and peritoneal effusions under the action of pilocarpine. Success, he says, depends upon the correctness of the diagnosis and the early adoption of the treatment.

PILOCARPUS.—See JABORANDI and PILOCARPINE.

PIMENTA (U. S. Ph., Br. Ph.), or *allspice*, is the dried fruit of *Pimenta officinalis*, a myrtaceous tree of tropical America. It is mildly *aromatic* and *astringent*, and is particularly useful in *flatulence*. The dose of pimenta in powder is from 10 to 40 grains; that of the volatile oil, *oleum pimentæ* (U. S. Ph., Br. Ph.), from 1 to 4 minims. Distilled water of pimenta, *aqua pimentæ* (Br. Ph.), may be used freely as an aromatic vehicle.

PIMPERNEL, PIMPINELLA, *radix pimpinellæ* (Ger. Ph.), or *saxifrage*, is the root of *Pimpinella Saxifraga* and *Pimpinella magna*, umbelliferous European plants. It was formerly in repute as a remedy for *chronic catarrh*, *amenorrhœa*, *asthma*, etc., being considered *diaphoretic*, *diuretic*, and *stomachic*. The dose of the tincture, *tinctura pimpinellæ* (Ger. Ph.), is from 20 to 30 drops, to be taken on sugar. (Cf. ANAGALLIS.)

PINE PREPARATIONS have a considerable popularity and a somewhat extended employment. Few of them are officially recognised, for whatever medicinal virtue they possess seems unquestionably to be due to the turpentines which they contain. (See TURPENTINE.) Pine in various forms occupies a high position in popular esteem, however, and residence in or near pine forests and even pine-leaf baths are reputed, on grounds which, if not of accurately determined value, are seemingly not unreasonable, as curative of *catarrhal* and *cutaneous affections* of a chronic type. In preparing a pine bath it is usual to add to water a decoction or a distillate of pine needles, the amount added being regulated by circumstances. The baths may be taken hot or cold. In the diseases mentioned, as well as in *rheumatic* and *gouty complaints*, they may not be altogether ineffectual. They are considerably employed at certain of the health resorts of Germany and Austria, where the "pine cure" is practised. A preparation known as fir-wool extract (*extractum pini silvestris*), obtained from pine leaves, is also used in preparing these baths. It is a syrupy liquid of a dark-brown colour and has a faint odour of pine. It is soluble in water, and, added to warm water in the proportion of from 2 to 4 oz. to 30 gallons, is used in the treatment of *rheumatism*. Woollen clothing is sometimes impregnated with the volatile oil derived from pine leaves, and is thought to be beneficial when worn by those suffering from rheumatic complaints. The cotton wool so medicated is sold in sheets under the name of "fir wool" or "fir-wool wadding."

Fir-wool oil, *oleum pini silvestris* (Br. Ph.), is a volatile oil distilled from the fresh leaves of *Pinus silvestris*, Scotch pine, or Scotch fir. It has little or no colour, an odour of pine leaves, and a pungent but not unpleasant taste. It is used in the preparation of fir wool, as already stated, may be rubbed on for the relief of various *rheumatic pains*, and may be used in the preparation of the pine bath, a drachm or more being added to the necessary quantity of warm water. Inhalation of fir-wool oil, *vapor olei pini silvestris* (Br. Ph.), consists of 40 minims of fir-wool oil rubbed up with 20 grains of light magnesium carbonate, with sufficient water added to produce 1 fl. oz. Of this, 1 fl. drachm is placed, with half a pint of cold water and half a pint of boiling water, in

an apparatus so arranged that air may pass through the solution and be inhaled. Thus inhaled, the preparation is useful as a mild stimulant in *chronic laryngitis*.

The volatile oil derived from *Pinus pumilio* (*oleum pini pumilionis*) is used in the same way, and is thought to be even more agreeable in odour and taste. It is known under the names of "pinol," "pumiline," and Krummholz oil. Soaps, pastiles, and other preparations are medicated with it. An extract derived from this source is also used for baths.

Various proprietary remedies containing pine preparations are sold in France. Of these, *pin d'Autriche* (*essence de Mack*) has as its important ingredient the oil of *Pinus pumilio*. It is used by inhalation and rubbing, and is suitable for *catarrhal conditions of the upper respiratory passages* and for *rheumatism*. *Pin maritime* (*pastilles Brachat*), another French preparation, contains lactucarium, codeine, and pine. It is used in *bronchitis*.

From pine wood there is prepared what is known as sanitary wood wool, or wood-wool wadding. This is the finely divided wood made antiseptic with corrosive sublimate. It is considerably employed as an *absorbent dressing* and to make various toilet conveniences, pads for receiving menstrual and vaginal discharges, absorbent mattresses, etc.

HENRY A. GRIFFIN.

PINKROOT.—See SPIGELIA.

PINOL.—See under PINE PREPARATIONS.

PINUS CANADENSIS, or *Abies canadensis*, the hemlock spruce of the United States and Canada, furnishes *pix canadensis* (*q. v.*), or Canada balsam. An unofficial extract has been used to some extent as an *astringent* and mild *local stimulant* in *leucorrhœa*.

PINUS SILVESTRIS (or *sylvestris*).—See under PINE PREPARATIONS.

PINUS STROBUS.—The bark of this tree, the American white pine, is extensively used in many parts of the United States as an *expectorant*, in the form of a syrup. This syrup is made by different manufacturing pharmacists according to processes of their own, so that the product varies somewhat. The last edition of the *National Formulary* gives a formula which, it is to be hoped, will henceforth be followed by the pharmacists. This is the formula:

White pine bark (*Pinus Strobus*)	75	grammes;
Wild cherry bark	75	"
Spikenard root	10	"
Balm of Gilead buds	10	"
Sanguinaria root	8	"
Sassafras bark	7	"
Morphine sulphate	0·5	"
Chloroform	6	c. cm.;
Sugar	750	grammes.
Alcohol	—	
Water	—	
Syrup (U. S. Ph.), of each a sufficient quantity to make 1,000 cubic centimetres.		

Reduce the vegetable drugs to a moderately coarse (No. 40) powder, moisten the powder with a menstruum composed of 1 volume of alcohol and 3 volumes of water, and macerate for twelve hours. Then percolate with the same menstruum until 500 cubic centimetres of tincture have been obtained, in which dissolve the sugar and the morphine sulphate; lastly, add the chloroform and sufficient syrup to make 1,000 cubic centimetres, and strain.

The dose of this preparation, which is termed *syrupus pini strobi compositus*, is from 1 fl. drachm to ½ fl. oz. The syrup is a modification of one recommended by Mr. Robert S. Sherwin in the *American Journal of Pharmacy* for May, 1896.

PIPER.—See PIPER NIGRUM.

PIPERAZIDINE, PIPERAZINE, or *diethylenediamine*, is obtained by the action of ammonia upon ethylene bromide or ethylene chloride. It occurs in colourless crystals of little or no odour and a faint saline taste. It is deliquescent and freely soluble in water, the aqueous solution being alkaline in reaction. The formula of piperazine is $C_4H_{10}N_2$.

The remedy was introduced into medical practice because laboratory experiments had shown it to be a powerful solvent of uric acid and because it was hoped that it might be available in causing increased elimination of uric acid from the body. From these laboratory experiments we learn that piperazine forms with uric acid a neutral and very soluble salt, piperazine urate, and even if the uric acid is present in excess this salt only is produced. As compared with lithium carbonate, we learn that piperazine will render soluble twelve times as much uric acid, and that piperazine urate is seven times as soluble in water as lithium urate is. The power of piperazine to cause the solution of uric acid in the laboratory is manifested not only upon granular uric acid, but also upon the hardest of uric-acid calculi; and even if the calculi are not formed purely of uric acid, piperazine may cause their disintegration by acting upon the uric acid which they do contain.

The physiological action of piperazine, so far as it has been studied, seems not very decided. The drug is not irritant and ordinarily is not toxic, though hallucinations, tremors, and spasmodic movements are said to have followed the use of large doses, while headache and vomiting have also been reported as sequels. The circulation and respiration seem little affected by piperazine, and digestion is not interfered with. Although it is possible that the remedy is partially oxidized within the body, it is mainly eliminated by the kidneys, unchanged and in combination with uric acid. The urine is said to be much increased in amount sometimes under the influence of piperazine, and some have even regarded the drug as a diuretic of sufficient activity to be useful in dropsies. This diuretic action of piperazine, however, is not reliable. The amount of urea eliminated by the urine is said to be increased under the influence of piperazine, while the amount of uric acid is lessened,

and from this it is inferred that piperazine acts to make oxidation more complete. These results have not been invariably observed, however, and some have found the elimination of urea and uric acid to be unchanged by it.

Piperazine has been used in a variety of disorders which, with more or less correctness, are thought to result from *uric-acid accumulation*. The results observed in these disorders have been contradictory, and latterly more suspicion has existed as to the value of the drug than was to be observed when first it was introduced. *Gout* in all its forms and manifestations is treated with piperazine, and in some cases with success. *Rheumatism*, too, is so treated, though scarcely effectively. *Uric-acid calculi* and *gravel* may perhaps be prevented from further increasing by the use of piperazine, but that their diminution is thus accomplished is to be doubted. In *cystic irritation*, either from uric-acid calculus or from highly-concentrated urine, attempts have been made at relief, not only by the internal use of the drug, but also by the vesical injection of a 1-per-cent. solution, and in the latter condition some success has followed the practice. In *lumbago* piperazine has been injected subcutaneously in a 2-per-cent. solution. Though this procedure is painful, it is said that abscess seldom results. Similar injections have been made in the neighbourhood of *gouty joints*, and some, with much faith, make external applications of piperazine in solution for a similar purpose. *Diabetes* is said sometimes to receive benefit from the use of piperazine, and when, as is frequently the case, glycosuria is present in the gouty, an improvement under the use of this agent might not seem surprising.

The daily dose of piperazine is usually 15 grains, and it is recommended that this amount be dissolved in water (a pint to a quart) each day, and that this solution be drunk at intervals. Larger doses may be given with safety, and 30 grains a day is with many the usual dose. Owing to its hygroscopic properties, piperazine is most satisfactorily administered in solution.

There are a number of preparations of piperazine. Granular effervescent piperazine contains 5 grains in a drachm. The dose is 1 drachm. Granular effervescent piperazine with phenocoll contains 5 grains of each in a drachm. The dose is 1 drachm. Aerated piperazine water contains 15 grains in each bottle. A bottle may be taken daily, and the aerated water is to some a pleasanter vehicle than ordinary water. Tablets of piperazine are also prepared for the sake of convenience in making the daily solution. Each tablet contains 15 grains.

It must be confessed that the expectations which were formed of piperazine when first the remedy was introduced have not been realized; and though in some few cases of uric-acid accumulation its administration may be attended with success, this is perhaps due rather to its alkaline reaction and possibly to its favouring the conversion of uric acid into urea by oxidation than to any power it has to act as a solvent of uric acid. In this connection the results of some recently conducted experiments are instructive. Bohland (*Therap. Monats.*, May, 1894) administered piperazine in a case of leucæmia in which the urine deposited a uric-acid sediment. The remedy was given in large doses and its use was continued for a long time, but not the slightest alteration was observed in the amount of uric acid eliminated. Schmidt, Bresenthal, and Levison have experimented upon healthy individuals with a similar result, and their conclusion is that the drug is useless to prevent the enlargement or to cause the solution of uric-acid concretions. Finally, though it is conceded that the solution of uric acid by piperazine is easily accomplished in the laboratory, it seems evident that the laboratory conditions can not be duplicated within the body. Bearing upon these facts are the much-quoted conclusions of Sharp and the more recent ones of Fawcett. Gordon Sharp (*Brit. Med. Jour.*, June 16, 1894) concludes: 1. Piperazine is not wholly oxidized in the body, and may be detected in the urine of those to whom it is administered. 2. Solutions of 1 per cent. in normal urine, when kept in contact with a fragment of uric-acid calculus at a temperature of 102·2° F. for a given time, have the property of dissolving it to a great extent. 3. The stronger the solution of piperazine in the urine the earlier does the solvent action begin, though the rate of solution is not so decidedly faster than with the weaker solution as might be expected. 4. The solvent action of piperazine is greater than that of other substances employed for the same purpose, such as borax, lithium citrate, sodium carbonate, and potassium citrate. 5. Piperazine in weak and strong solutions converts the undissolved portion of the calculus into a soft granular or pulpy material.

Sharp, however, has shown that from the daily administration of 30 grains of piperazine there are eliminated unoxidized, by the urine, but 5 grains. This would mean a urinary solution of about 0·02 per cent. The solutions which Sharp used in his experiments were far stronger than this, and were such as could by no possibility be obtained by the clinical use of the drug. Fawcett has called attention to these facts and has gone so far as to prove that even 1-to-1,000 solutions of piperazine in urine are inert, and therefore we are forced to the conclusion that the clinical employment of piperazine as a uric-acid solvent of any importance is unreasonable.

[Dr. John McKinlock, of Chicago (*N. Y. Med. Jour.*, Aug. 18, 1894), reports four cases of *renal colic* in which he used piperazine with very satisfactory results. He used large doses, in one case as much as 2 drachms in the course of the first day.

A case of *poisoning with piperazine* has been reported by Dr. Charles H. P. Slaughter, of Philadelphia (*Med. News*, March 14, 1896). Dr. Slaughter had prescribed three powders, each to contain 20 grains of piperazine, for a woman, thirty-two years old, who had great acidity of the urine. Each of the powders was to be dissolved in a pint of water and

taken in the course of twenty-four hours, but the woman took the 20 grains all at once, dissolved in a pint of water. It seems to have been three or four hours after this that Dr. Slaughter was called to see her. He found her greatly cyanosed and semi-comatose, and it was necessary to arouse her to obtain any reply to inquiries. Her pupils were minutely contracted, the pulse 50, and the temperature 97·4° F. The respirations were very much depressed and a low muttering delirium prevailed. The tips of the fingers and the lips were cyanotic, and on her attempting to walk, complete loss of the power of motion was observed in both lower limbs, while sensation was well preserved. The symptoms are said by Dr. Slaughter to have been most alarming. He administered cardiac and respiratory stimulants, using at the same time external heat and elevating the lower limbs. The woman also received a high stimulating rectal injection and was catheterized. It was only after several hours of treatment, persistently administered, that reaction occurred. On the next day Dr. Slaughter visited her and found the loss of motion returning and also a marked hypostatic congestion of both lungs. Upon the sixth day the paraplegia had vanished, and the woman finally made a complete recovery. The paralysis was treated with large doses of strychnine and with massage.]

HENRY A. GRIFFIN.

PIPERIDINE, $C_5H_{11}N$, an alkaloid, is a colourless liquid having an odour of ammonia and pepper. It is obtained by the decomposition of piperin. It is readily soluble in water and in alcohol. Dr. Arthur R. Cushny, of the University of Michigan (*Exper. Med.*, Jan., 1896), has experimented extensively with piperidine, but thus far there are no accounts of its having been used in medicine. Dr. Cushny and others have found that its toxic properties resemble those of curare and coniine, but are much feebler.

PIPERIN, PIPERINE.—Piperine, as this principle should be termed if it is an alkaloid, bears the name *piperinum* in the U. S. Ph., indicating that it is considered to be a neutral principle. The U. S. Ph. of 1880, however, had described it as a "principle of feebly alkaloidal power," and the authors of the *United States Dispensatory* seem justified in remarking that "this should have been retained at least until it had been proved beyond question that this description was incorrect." Piperine has been regarded as a compound of piperidine and piperinic acid, having the formula

It is obtained from the fruit of *Piper nigrum*, or black pepper. It is a tasteless crystalline substance, insoluble in cold water, soluble in alcohol, in ether, and in chloroform. It has been used to some extent as an *antiperiodic* in *malarial affections*. The dose is from 1 to 5 grains, which may conveniently be given in the form of a pill.

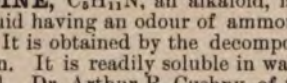
PIPER NIGRUM (Br. Ph.), *piper* (U. S. Ph.), black pepper, is the dried unripe fruit of *Piper nigrum*, the pepper vine of various tropical countries, mostly Asiatic. It is used chiefly as a *condiment*, but occasionally also as a *carminative* and as a remedy for *malarial affections*.

Pepper is the chief ingredient of Ward's paste, a compound formerly much used in the treatment of *hæmorrhoids*. An old official equivalent of Ward's paste, that of the Lond. Ph., was made after the following formula:

℞ Powdered black pepper, Powdered elecampane,	each..	1 part;
Powdered fennel.....		3 parts;
Honey, Sugar,	each.....	2 "

From 1 to 2 drachms of this paste may be taken three times a day. The ordinary ground black pepper of the table is a very efficient *hæmostatic* in cases of *small wounds*. The dry powder should be applied copiously. It acts mechanically and does not give rise to the slightest pain. The dose of pepper for internal administration is from 10 to 20 grains. Oleoresin of pepper, *oleoresina piperis* (U. S. Ph.), may be given in doses of from ¼ to 1 minim, in a pill. The dose of confection of pepper, *confectio piperis* (Br. Ph.), is from 1 to 2 drachms.

PIPERONAL, called by perfumers *heliotropin*, is a crystalline substance obtained by the oxidation of piperinic acid and having the formula



It has been proposed as an *antipyretic* and *antiseptic*, but has not been much employed. The dose is 15 grains.

PIPSISSEWA.—See CHIMAPHILA.

PISCIDIA, Jamaica dogwood, is the bark of the root of *Piscidia erythrina*, a tree growing in the West Indies. The bark is imported in small pieces, which have a heavy, narcotic odour when broken, and a bitter, acrid taste. The active principle of the bark is as yet undetermined, though it contains oil, tannin, resins, and a peculiar colourless, crystallizable substance—a neutral principle, called *piscidin*. This is soluble in alcohol, but is insoluble in water. The physiological action of piscidia has not been sufficiently studied, but, so far as may at present be judged, it appears to be possessed of *soporific* and *anodyne* powers, but to be far weaker in action than opium. It possesses the advantage, however, of causing no unpleasant after-effects and no injurious influence upon digestion. Piscidia is said to diminish reflex irritability, to cause dilatation of the pupil, to increase the salivary flow and the cutaneous secretion, to cause slowing of the heart and increased arterial tension from stimulation of the vaso-motor centre, and, finally, to cause lowered blood-pressure from cardiac weakening. It may, it is said, cause tetanic spasms from irritation of the spinal centres, and, if given in sufficient amount, may produce death from respiratory or cardiac paralysis.

The *analgetic* power of piscidia seems a local

one as well as constitutional, and it may be applied with benefit in such painful conditions as *toothache*, *burns*, *scalds*, and *hæmorrhoids*. Internally, piscidia may be used as a substitute for opium in cases in which that drug is not well borne. It is said to be especially suitable, therefore, for use in the young and the aged, and it is probably less disturbing to the digestion. That it is entirely inactive upon digestion would seem, however, to be disproved by the case reported by H. C. Wood, in which nausea and gastric distress followed its employment, without any narcotic effect whatever. Piscidia may be given to cause sleep, to diminish *nervous irritability*, to lessen reflex action and *spasm*, and to relieve *pain*. *Neuralgias* of various sorts are often favourably affected by piscidia, though its beneficial action is not invariable, and, in cases of great severity, it is apt to fail. If we are to believe its advocates, there is no form of pain in which piscidia is not efficient, and, indeed, in many cases it is productive of much relief, but in many cases it fails. In *spasmodic dysmenorrhœa* it acts both as an antispasmodic and as an anodyne, and often appears to be of benefit. In the same way it may be efficient in quieting the *pains of abortion*. As an antispasmodic, it has been said to cause relief in *asthma*, *whooping-cough*, and even *chorea*, but its sedative action is especially valuable in quieting the *irritable cough* which accompanies *bronchitis* and *phthisis*. It has the advantage, too, of not interfering with expectoration. In *insomnia* of various sorts piscidia is often efficient; though in severe cases of this symptom, such as are witnessed in alcoholics, it may fail, it is said, on the other hand, to be very useful in *pure nervous insomnia*, and also to be highly efficient in the relief of *hysterical states* in general.

Several preparations of piscidia are to be obtained, but the most reliable is the fluid extract. Of this the dose is from ½ to 1 fl. drachm, which may be cautiously increased if necessary.—Henry A. Griffin.

PISTACIA LENTISCUS.—This anacardiaceous tree, growing on the shores of the Mediterranean, is the source of mastic (*q. v.*).

PITCH.—See Pix burgundica, Pix canadensis, Pix liquida, and Tar.

PITUITARY-BODY EXTRACT.—In the article on Animal extracts and juices it was stated (vol. i, page 81) that this extract had been recommended in the treatment of *acromegaly*. Marinesco (*Semaine méd.*, Nov. 13, 1895; *Brit. Med. Jour.*, Dec. 7, 1895, *Epitome*) has since reported three cases of that disease in which he gave the pituitary body in substance. In two of the cases the patients, a woman aged fifty-three and a man of fifty-four, were examples of the massive type of the disease; the third, a woman aged about thirty, was an example of the giant type. Under the treatment the headache, which in the "massive" cases was extremely violent, diminished considerably in intensity, but the remedy had no effect on the neuralgic pains in the limbs. The general condition was improved, but Marinesco could not detect the slightest diminution in the size of the affected extremities. The most definite objective effect of the treatment was increased diuresis. Without denying that suggestion may have had some part in the matter, Marinesco believes that the treatment had some action, either on the pituitary tumour or on the encephalic circulation. He states that both Marie and he believe that acromegaly depends on perverted function of the pituitary body, but they reject Tamburini and Massalongo's hypothesis that the hypertrophy of acromegaly is a result of pituitary supersecretion. In certain cases post-mortem examination has shown that the pituitary body had undergone a heterogeneous transformation, the gland cells having been replaced by elements of a different kind, incapable of supplying the normal secretion of the gland.

PIX BURGUNDICA (U. S. Ph., Br. Ph.), or Burgundy pitch, is the resinous exudate of a variety of pine. It is soft and adhesive at the temperature of the body. Spread upon leather, etc., it is used as a *rubefacient* plaster in *chronic rheumatism*, *pulmonary affections*, etc., in which mild and long-continued counter-irritation is desired. *Emplastrum picis burgundicæ* (U. S. Ph.), Burgundy pitch plaster, is used as above stated. *Emplastrum picis* (Br. Ph.), pitch plaster, is essentially the same.

[*Emplastrum picis cantharidatum* (U. S. Ph.), cantharidal pitch plaster, is a compound of 8 parts of cerate of cantharides and 100 of Burgundy pitch. It is somewhat more active than ordinary pitch plaster, and is used for the same purposes.]—Russell H. Nevins.

PIX CANADENSIS, or the resin of the common American hemlock, has been employed in the same manner and for the same purposes as Burgundy pitch, but is less suitable on account of its lower melting point and consequent lack of adhesiveness at the temperature of the body.—Russell H. Nevins.

PIX LIQUIDA (U. S. Ph., Br. Ph., Ger. Ph.), or common tar, is a black, tenacious, semifluid substance obtained from various species of pine. In some respects it is similar in its action to turpentine, than which, however, it is more useful in the treatment of *pulmonary affections*. In *winter cough*, given in the pill form in 2-grain doses three times a day, it usually diminishes the expectoration and reduces the frequency of the paroxysms of coughing. *Chronic bronchitis* also is benefited by its administration in this manner, but the ordinary tar water is probably as effectual and is more easily obtained. The inhalation of the steam arising from hot tar water, or the vapour given off from heated tar, is more or less useful in allaying the cough of all pulmonary affections, but it has no curative effect in phthisis, as was held at one time. Though possessed of slight diuretic properties, it is rarely used as a diuretic, for it has no advantages over the other diuretics.

Syrup of tar, *syrupus picis liquidæ* (U. S. Ph.), is regarded by some as being less irritating than either tar itself or tar water. It has

all the active properties of tar, and may be given in doses of from 1 to 2 fl. drachms. Tar water, *aqua picis* (Ger. Ph.), may be prepared extemporaneously by allowing 4 parts of water and 1 part of tar to stand for twenty-four hours, and decanting off the water, which is the portion used, at the end of that period. It may be given almost *ad libitum*, and sometimes is useful, when injected into the bladder, in allaying the irritation of *chronic cystitis*.

Saccharated tar contains about 4 per cent. of tar, is freely soluble in water, and may be substituted for the syrup. A mixture of tar and charcoal readily allows of the solution of the tar in water, which may also be vaporized when sprinkled upon any hot surface.

Externally, tar is *stimulant* and is very largely employed in the treatment of *tinea capitis*, *psoriasis*, *lepra*, and some of the *scaly forms of eczema*.

In these affections it may be painted upon the affected surface or applied in the shape of a soap, an ointment, or the unofficial *liquor picis alkalinus*. This latter contains 2 parts of tar, 1 part of caustic potash, and 5 parts of water. When dried upon the skin it is only slightly sticky. Tar soaps are unofficial and vary considerably in strength, etc., so that it is important that a well-known brand should be selected.

Tar ointment, *unguentum picis liquidæ*, contains, according to the U. S. Ph., 50 per cent. of tar; that of the Br. Ph. consists of 5 parts of tar and 2 of yellow wax. The British ointment is therefore considerably the stronger. (Cf. TAR.)—RUSSELL H. NEVINS.

PIXOL.—This name has been given to a *disinfectant* made with tar, soft soap, and caustic potash. Dr. Doukalsky, physician at the military hospital at Keltzy, is cited in the *Province médicale* for November 17, 1894, as saying that painting with a watery solution of pixol of from 10 to 13 per cent., repeated two or three times a day, is an excellent means of treating *acute dermatitis* produced by the too energetic employment of ointments for the itch, mercurial frictions, and other medicinal applications. Under the influence of pixol the *itching* becomes less intense almost immediately, and the inflammatory symptoms disappear in a few days. These paintings give equally good results in the treatment of *psoriasis*, *simple chancres*, and *wounds resulting from opening virulent buboes*.

PLACEBOS.—For some reason the use of placebos, or preparations made of inert substances or those nearly so, appears to have in a measure been abandoned, but there are, without doubt, conditions in which they may play a useful part. These cases may be roughly divided into two classes, the one including those in which the desires and notional ideas of the patient are to be gratified, and the other those in which it seems wise to gratify the wishes of the patient, friends, and attendants, and to assure them that something is being done. In the first class it is desirable that the preparation employed should be sapid, but in the latter this is of little moment and it is often better that it should be without taste. It is also of advantage that in the first class the sympathies of the patient should be aroused, the expected action of the remedy explained in detail, and the most minute directions given as to the time, manner, etc., of taking it, adding, if possible, an air of mystery. As the persons for whom this class of remedies is applicable are impressible, it is wise to call that trait into play. For adults, probably as good as anything would be the infusion of hops or that of quassia, which are certainly harmless enough and yet can not be called insipid. The time-honoured bread-pill may be used if desired, or one of extract of licorice if one having an odour and colour seems preferable. Often, especially among the ignorant, patients may insist upon something having a moderate physiological effect; for them the rhubarb-and-soda mixture is very appropriate and certainly is nasty enough not to lead one to acquire the habit of abusing it. Small amounts of potassium bromide, aromatic spirit of ammonia, or compound tincture of lavender may be useful in the case of hysterical women and girls. When the hypodermic use of morphine has been practised for a considerable period and patients call for it at certain regular intervals, distilled water in which an inert disc or tablet is dissolved in their presence will usually assist very materially in dispensing with the morphine.

In acute cases, when it seems desirable to employ medication for the purpose of allaying the anxieties of the friends and others, the patient being indifferent, it is best to make use of some preparation entirely or nearly tasteless, which should be supplied by the medical attendant rather than the apothecary, and be as easy of administration as possible. Plain water or that to which a slight taste and colour have been imparted by gentian, or something similar, may be employed, a drop or two of glycerin placed upon the tongue at regular intervals, or some such simple procedure as sponging undertaken, but caution must be observed in critical cases, where all that can be done is to await developments, not to unduly disturb the patient. For children, almost any preparation of an agreeable odour and taste, such as syrup of raspberry, is appropriate, except in the febriculæ of childhood, calling for no particular treatment, when sweet spirit of nitre is preferable, as it is held in high esteem by the laity in such conditions, and in small doses is entirely harmless and may probably render the patient slightly more comfortable. For infants probably nothing is so safe or desirable as fractional doses of pepsin.

RUSSELL H. NEVINS.

PLASTERS.—These are compounds of various fusible solids of a melting point higher than that of the human body, being brittle when cold, but rendered adhesive by the warmth of the body, and usually the bearers of some medicament.

Plasters may be divided into plaster-masses and into spread plasters.

In the preparation of plaster-masses the heat employed should not be greater than is neces-

sary to produce a homogeneous mixture, more particularly if a medicinal substance containing readily perishable active principles is to be added, such as extract of belladonna.

Owing to the introduction of the rubber base for plasters, it is but seldom that the apothecary is called upon at the present time to prepare a plaster except for blistering purposes, in which case he spreads the ceratum cantharidis on a suitable fabric. Practically, all other plasters are now prepared on the manufacturing scale, and most of them with a base consisting in part of rubber.

The composition of the rubber plaster base is stated to be, approximately, India rubber, 2 parts; Burgundy pitch, 1 part; olibanum, 1 part. The rubber has to undergo protracted treatment in washers and crushers before it is clean and pliable enough to be worked up with the other ingredients. The mass is then mixed with the medicinal agent in proper proportion and spread upon muslin by special machinery. To enable the perspiration of the skin to escape from underneath a plaster, it has become customary to make it "porous"—that is, to perforate it with numerous small holes, for which special machines are used by the manufacturers. On hand-made plasters this may be done by a small apparatus devised by Professor Remington, being a small revolvable wheel carrying two rows of punches on its circumference.

Competition has caused a considerable amount of practically worthless rubber plasters to make their appearance on the market. It is therefore best to specify the maker's name when ordering these. The large houses, whose names are well known, carefully control the quality of their output in their own interest.

CHARLES RICE.

PLASTER OF PARIS.—Only plaster from which most of the water has been driven off by means of heat, *calcii sulphas exsiccatus* (U. S. Ph.), *calcii sulphas* (Br. Ph.), *calcium sulfuricum ustum* (Ger. Ph.), is recognised. If it can not be readily obtained freshly prepared, it must be kept in well-closed bottles. Besides its uses in surgery and for making casts, which do not come within the scope of this work, plaster of Paris applied in paste to a tumour, for example, sometimes acts well as a placebo in the case of an ignorant and timid patient. The process of taking a cast of the tumour is apt to be interpreted by such a person as a therapeutic procedure, and may cheer and sustain him during the few days for which it may be wise to postpone a surgical operation.

PLEURISY ROOT.—See ASCLEPIAS TUBEROSA.

PLUMBUM.—See LEAD.

PNEUMATIC CABINET, PNEUMATIC CHAMBER, PNEUMATIC CUIRASS, PNEUMATIC DIFFERENTIATION, PNEUMATIC TUB.—See under AIR, CONDENSED OR RAREFIED (vol. i, pages 18, 19, 20, and 21).

PODOPHYLLIN, *podophyllinum* (Ger. Ph.), is a name which is improperly applied to the resin of podophyllum, *resina podophylli* (U. S. Ph.), *podophylli resina* (Br. Ph.), and its use should therefore be abandoned.

Resin of podophyllum is an amorphous powder which varies in colour from grayish white to greenish yellow. It has a faint but peculiar odour and a peculiar and bitter taste. It is permanent in the air, but becomes darker at temperatures above 95° F. It is freely soluble in alcohol and partially soluble in ether. It is composed of two resins; one is soluble in alcohol and in ether, the other only in alcohol. As to the relative powers of these two, opinions differ, but there seems reason to believe that the resin soluble in ether represents the greater part if not the whole of the mixture's activity.

The action of resin of podophyllum, when given by the mouth and in medicinal doses, is to increase the intestinal secretions and cause catharsis; in some cases it produces nausea and occasionally vomiting. It is somewhat slow in its action; from six to ten hours usually elapse before purgation begins. The movements it causes are usually large and fluid. The action of resin of podophyllum, when given uncombined, is somewhat severe, and griping is generally an accompaniment, but in combination with an antispasmodic, like belladonna or hyoscyamus, the remedy is usually not unpleasant. The action of the resin upon the hepatic function is pronounced, the production of bile being directly stimulated by it, as the much-quoted experiments of Rutherford have shown. It is certainly proved that the action of resin of podophyllum follows its absorption, for catharsis has resulted from its hypodermic administration to animals, and its application to an ulcerated surface has had a similar result. That the drug has any constitutional effect is improbable.

In large doses the remedy is poisonous; the symptoms observed have been vomiting, excessive purging, violent abdominal pain, and collapse. Convulsions have also been noted in podophyllum poisoning. The treatment in cases of such poisoning must be symptomatic and sustaining; opium, of course, is generally required.

Constipation, whether occasional or habitual, may well be treated with podophyllum. For the latter state the drug is more suitable in cases in which the constipation is dependent upon deficiency of hepatic or intestinal secretion than in those where muscular atony is the cause, though even in that condition the remedy is not without effect. From its cholagogue power, resin of podophyllum is useful in a variety of hepatic disorders, among them *functional disturbances of the liver*, *portal congestion*, and *catarrhal jaundice*. The familiar "*bilious attack*" may be benefited by a podophyllum purgation, and in *malarial infection* the digestive disturbances may be relieved by it as they are by calomel. Podophyllum was formerly thought to diminish arterial excitement and lessen cough when given in small and repeated doses. It was thus used in *hæmoptysis* and *respiratory catarrhs*, but it can not be said that the value of the treatment

is evident. The remedy is seldom given alone, but is frequently employed in combination with other cathartic drugs, as in the vegetable cathartic pill (see CATHARTICS), and with intestinal antispasmodics. The dose of the resin as a purge is from $\frac{1}{6}$ to $\frac{1}{4}$ of a grain; as a laxative, from $\frac{1}{12}$ to $\frac{1}{8}$ of a grain. It is usually administered in pill.—HENRY A. GRIFFIN.

PODOPHYLLOTOXIN.—This principle, $C_{22}H_{24}O+O2H_{29}$, obtained from *Podophyllum peltatum*, is said to have the therapeutical properties of resin of podophyllum; it is so violent a poison, however, that its use as a medicine is not to be recommended.

PODOPHYLLUM (U. S. Ph.) is the rhizome and roots of *Podophyllum peltatum*, or the May apple, a berberideous herb indigenous to the United States. The therapeutical properties of podophyllum are those of the resin, *resina podophylli* (U. S. Ph.), *podophylli resina* (Br. Ph.), *podophyllinum* (Ger. Ph.); for an account of them the reader is referred to the article on PODOPHYLLIN. The other official preparations of podophyllum are the following: The extract, *extractum podophylli* (U. S. Ph.), the dose of which is from 1 to 3 grains; the fluid extract, *extractum podophylli fluidum* (U. S. Ph.), the dose of which is from 5 to 15 minims; and the tincture, *tinctura podophylli* (Br. Ph.), the dose of which is from 15 minims to 1 fl. drachm. These preparations are hardly ever employed, and it may be said that the powdered root itself is practically never administered; the resin (podophyllin) is the form in which the remedy is almost invariably used.

POISONS.—See ANTIDOTES and ANTAGONISTS, also the articles on the individual poisons.

POKEBERRY, POKEROOT.—See PHYTOLACCA.

POLYGALA.—See SENEGA.

POLYGONUM BISTORTA.—See BISTORT.

POLYGONUM HYDROPIPER.—This plant, the water-pepper, or *Persicaria urens*, has been studied by Dr. C. J. Rademaker (*Am. Jour. of Pharm.*, November, 1871), who says he has frequently known it to be used, in the form of a tincture or a fluid extract, in *amenorrhœa* and "other uterine disorders" with very satisfactory results. Dr. Rademaker concluded that the medicinal properties of the plant resided mainly in an acid that he found in it, which he named *polygonic acid*. Dr. Cerna states that the preparation generally used is a fluid extract, of which the dose is from 15 to 30 minims.

POLYPORUS FOMENTARIUS.—*Agaricus chirurgorum* (see under AGARIC).

POLYSOLVES, or *solvines*, are sulphoricinates of alkalies. When dissolved in water, they enable the water to mix with various substances that ordinarily are not miscible with it.

POMEGRANATE, *granati radicis cortex* (Br. Ph.).—See under PELLETIERINE.

POMMADES.—See OINTMENTS.

POPLAR.—See POPULUS.

POPPY.—Poppy heads, *papaveris capsulæ* (Br. Ph.), *fructus papaveris immaturi* (Ger. Ph.), are the dried capsules of *Papaver somniferum*. Those of the Br. Ph. are grown in Britain. They contain a very small and varying amount of opium and are very uncertain in their action. They are employed for the relief of *pain*, etc., in an emulsion for external use, an official decoction, *decoctum papaveris* (Br. Ph.), an extract, *extractum papaveris* (Br. Ph.), and a syrup, *syrupus papaveris* (Br. Ph.), *sirupus papaveris* (Ger. Ph.). The decoction is employed topically as an *anodyne*. The dose of the extract is from 2 to 5 grains, and that of the syrup is from $\frac{1}{2}$ to 1 fl. drachm. There is little to recommend the use of these preparations, as their composition is extremely uncertain and they possess no advantages over the preparations of opium and its alkaloids. A bland oil is made from the seeds which is employed as an illuminant and as a food in many parts of the world.

Syrup of red poppy, *syrupus rhœados* (Br. Ph.), is an inert preparation, valued solely on account of its bright-red colour, used as a vehicle in cough mixtures, etc.

RUSSELL H. NEVINS.

POPULUS.—Several species of poplar, a genus of salicineous trees, have been more or less used in medicine, and the black poplar, *Populus nigra*, indigenous to Europe, was formerly official. The buds are balsamic, and are occasionally used in the preparation of *pectorals*. The recently dried buds are an ingredient of poplar ointment, *pomatum populeum* (Fr. Cod.), *onguent populeum*, *pommade de bourgeon de peuplier*, which is used to some extent in Europe as an *anodyne*. Poplar buds are said to contain a principle that preserves ointments to which it is added from becoming rancid. The bark of *Populus tremula*, which contains salicin, and that of *Populus tremuloides*, the American aspen, are *tonic* and *antiperiodic*, and have been employed with success in the treatment of *malarial fevers*.

Populin, a glucoside having the composition $C_{20}H_{22}O_8 + 2H_2O$, is found, along with salicin, in the bark and leaves of *Populus tremula*, *Populus alba*, and *Populus græca*; it has also been made synthetically. It is used as an *antipyretic* in doses of from 2 to 4 grains.

POTASH, POTASSA (U. S. Ph.), **POTASSA CAUSTICA** (Br. Ph.), *potassium hydrate*, or *caustic potash*, is a highly corrosive substance used in medicine as a *caustic* (cf. CAUSTICS), in the preparation of a number of potassium salts, and very largely in the arts in the manufacture of soap, etc. In common with the carbonates and organic salts of potassium, potash has a decided action in rendering the fluids of the body alkaline, and these compounds are very extensively employed in the treatment of *rheumatism*, *gout*, the *uric-acid diathesis*, and other conditions in which alkalinity of the urine is desirable. They also may be employed to correct undue *acidity of the stomach*, but are inferior for this purpose

to soda and the sodium salts. Solution of potash, *liquor potassæ* (U. S. Ph., Br. Ph.), *liquor kali caustici* (Ger. Ph.), contains about 6 per cent. of the anhydrous potassa, and is the only preparation which can be used with safety for internal administration. It is less useful, however, than the potassium carbonates or citrates, and is rarely dispensed for internal use. It may be given in doses of from 15 to 60 minims, largely diluted with water. Externally, it is employed, when diluted, in *cutaneous affections* characterized by acid secretions, to remove crusts, etc. Without there seeming to be any rational explanation of its mode of action, the undiluted solution, painted every hour or two upon a *felon* during its early stages, will without doubt in many instances abort it. In household practice a poultice containing a considerable quantity of unleached wood ashes is used for the same purpose, and with good results, which are due to the potash contained in the ashes.

[In the employment of potash as a *caustic*, the pencil, or stick, of fused potassa, *kali causticum fusum* (Ger. Ph.), *potassa fusa*, may be moistened and rubbed on the skin, the surrounding parts being protected by being covered with adhesive plaster. It should be remembered that the eschar is apt to be larger than the area to which the caustic has been applied. *Potassa cum calce* (U. S. Ph.), or Vienna caustic, is treated of in the article on CAUSTICS (see vol. i, page 228). The *liquor potassæ effervescens* of the Br. Ph. is really not a solution of potash, but of potassium bicarbonate in carbonic-acid water; it probably owes its official name to the same conventionality that leads us to speak familiarly of sodium bicarbonate as "soda." The solution is a very weak *antacid* and *gastric stimulant*. It may be taken freely. For *potassa sulphurata*, see under SULPHUR.]—RUSSELL H. NEVINS.

POTASSIUM ACETATE, *potassii acetas* (U. S. Ph., Br. Ph.), *kalium aceticum* (Ger. Ph.), is quite effectual in rendering the fluids of the body alkaline; it is also *diuretic*, and in moderately large doses *laxative*, although it is rarely employed to act on the bowels, as it is rather more disagreeable to the taste than most of the other salines. It may be employed in the treatment of *acute rheumatism* by the alkaline method (cf. ALKALIES), from ½ to 1 oz. being given during each twenty-four hours, but the bicarbonate is less unpleasant and just as efficacious. As might be assumed, it is useful in the *uric-acid diathesis* and in the various *cutaneous affections* assumed to depend upon that state. It will be found, however, that the bitartrate is rather more efficient and less unpleasant than this salt, and is, as a rule, preferable. As a diuretic, potassium acetate may be given in doses of from 20 to 60 grains, and as a cathartic in quantities up to ½ oz., well diluted, as it may otherwise give rise to gastric distress and irritation.—RUSSELL H. NEVINS.

POTASSIUM AND SODIUM TARTRATE.—See under POTASSIUM TARTRATES.

POTASSIUM BICARBONATE. — See under POTASSIUM CARBONATES.

POTASSIUM BICHROMATE, *potassii bichromas* (U. S. Ph., Br. Ph.), *kalium dichromicum* (Ger. Ph.), is a very irritating and *caustic* salt, not very extensively employed in medicine. In saturated solutions it may be employed to remove *warts*, *corns*, and other *morbid growths of moderate size*. In a 1-per-cent. solution it is *astringent* and more or less of a *deodorizer*, but is rarely used except when it happens to be the only body of that nature at hand. A fluid for use in zinc-and-carbon batteries may be made of 6 oz. of this salt, 6 fl. oz. of commercial sulphuric acid, and 48 oz. of cold water, but as a rule sodium bichromate is employed, as it is much cheaper and more soluble in the water. *Müller's fluid*, used for the preservation of anatomical specimens, contains from 2 to 3 parts of this salt, 1 part of sodium sulphate, and 100 parts of water. In poisonous doses, the effects of potassium bichromate vary little from those of other caustic bodies, severe irritation of the alimentary canal, pain, coma, collapse, etc., being the most prominent symptoms. Magnesia, soap, and the alkaline carbonates are the proper antidotes. It is largely employed in the arts, and the dust and vapour arising from it and its solutions often cause ulceration of the mucous membrane of the nose.—RUSSELL H. NEVINS.

POTASSIUM BISULPHATE.—See under POTASSIUM SULPHATES.

POTASSIUM BITARTRATE.—See under POTASSIUM TARTRATES.

POTASSIUM BROMIDE, *potassii bromidum* (U. S. Ph., Br. Ph.), *kalium bromatum* (Ger. Ph.).—See under BROMIDES and under MOTOR DEPRESSANTS (vol. i, page 644).

POTASSIUM CARBONATES.—Potassium carbonate, *potassii carbonas* (U. S. Ph., Br. Ph.) *kalium carbonicnm* (Ger. Ph.), is, in large quantities, highly corrosive, and may give rise to the same effects as those of caustic potash. It is employed as an *antilithic*, as an *antacid*, and in the treatment of *acute rheumatism* (cf. ALKALIES). Being very soluble in water, it is a very appropriate salt to use when the constitutional effects of potash are desired. It may be given in doses of from 10 to 30 grains in very dilute solution, and is also added to water to form an alkaline bath, about 10 oz. being used for each bath. For the removal of crusts, etc., in various cutaneous affections, it may be substituted for sodium carbonate when a more energetic action is desired.

Potassium bicarbonate, *potassii bicarbonas* (U. S. Ph., Br. Ph.), *kalium bicarbonicum* (Ger. Ph.), differs but little in its effects from the carbonate and is adapted to the same purposes, except when the evolution of considerable amounts of carbonic-acid gas in the stomach is undesirable. When it is added to lemon-juice or a solution of citric acid moderate effervescence takes place, and a citrate is formed which is identical in its effects with the official salt. The bicarbonate may be used in doses of from 20 to 60 grains.

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POTASSIUM CHLORATE, *potassii chloras* (U. S. Ph., Br. Ph.), *kalium chloricum* (Ger. Ph.), is very largely used in the treatment of all forms of *stomatitis, salivation* due to mercury or its salts, *sore throat, hoarseness,* and *pharyngitis.* It is popularly supposed to be entirely harmless, but, as a matter of fact, it is a powerful depressor of the heart's action, and, passing unchanged out of the body by the urine, acts as a strong irritant to the kidneys, and in large quantities is more or less corrosive. In the treatment of the affections mentioned it may be used in solutions having a strength of from 1 to 2 per cent., or in the shape of troches, one form of which is official in the Br. and U. S. Ph's under the title of *trochisci potassii chloratis.* From 1 to 6 lozenges are allowed to dissolve slowly in the mouth. If potassium chlorate is given at the same time with mercurials, it is probable that salivation will be less apt to occur than if it were omitted. Externally, it has been employed as an application to *unhealthy ulcers,* etc., either in the shape of the powder or in saturated solutions.

In *scarlet fever* and *diphtheria* its local action upon the throat may be slightly beneficial, but it should be used as a gargle or applied with a brush or swab, and as little as possible allowed to enter the stomach, as its effects upon the kidneys render it particularly dangerous in these diseases. It should never be combined with sulphur, sugar, or any substance containing considerable amounts of oxygen, as an explosion would be pretty sure to result if the proper conditions of heat, etc., existed. The ordinary dose of this salt is 5 grains, but double that quantity may be given with safety. Provided the troches do not contain more than 5 grains, which is practically the strength of the official variety, and they are allowed to dissolve slowly in the mouth, there is little or no danger of an overdose, even if they are employed almost continuously.

[Dr. Dumontpallier recently stated before the Paris Academy of Medicine (*Presse méd.,* March 18, 1896; *N. Y. Med. Jour.,* April 11, 1896) that he had had occasion to employ this drug in three cases of *tumours of the gums* and of *the tongue,* the aspect and progress of which had presented a certain gravity. One patient had been operated on for epithelioma of the right lateral border of the tongue, and during his convalescence a recurrent nodule was discovered near the cicatrix. Cauterization with silver nitrate was practised three times at intervals of several days, but the epithelial nodule increased. At this time M. Dumontpallier saw the patient and made an examination of the tumour, which had developed rapidly, and found that it was situated on the right border of the tongue, about five centimetres from the end of the organ. In size and shape it was like a large bean, and papillomatous in appearance. It was sessile and adherent, and it had caused much annoyance and pain on mastication. There was no submaxillary adenopathy. The author prescribed potassium chlorate as a local application in the form of powder, which was to be applied six times a day. At the same time a solution of 60 grains of the potassium salt in 4½ ounces of water was to be given in doses of a tablespoonful every four hours. In this way, said the author, the tumour was kept under the constant influence of the drug, as it was freely eliminated by the saliva. This treatment had been continued regularly for six weeks, and at the end of that time the tumour had been reduced to half of its original size, and three weeks later there existed only two small protuberances, which were not painful. About two months afterward M. Dumontpallier saw the patient again, and found only three whitish, shining cicatricial bands corresponding to the course of the operative wound. At the time of the report the recovery was complete.

M. Dumontpallier said that the favourable results had certainly been due to the use of the potassium chlorate, and that its elimination by the salivary secretion had acted continually on the diseased surface. He recommended this drug in cases of tumour of the mouth, in which the diagnosis was often doubtful, and thought it ought to be given a trial before resorting to a cutting operation. In order, he said, to bring about good results from this treatment, it should be continued for two or three months; it was also absolutely necessary to be assured of the functional regularity of the kidneys, which, with the salivary glands, were the principal organs of its elimination. It was also prudent to ascertain if the condition of the teeth was not a cause of irritation to the affected surface, and to institute the proper treatment.]—RUSSELL H. NEVINS.

POTASSIUM CHLOROCHROMATE, on the addition of hydrochloric acid, evolves chlorine and may be employed as a source of that gas.—RUSSELL H. NEVINS.

POTASSIUM CITRATE, *potassii citras* (U. S. Ph., Br. Ph.), is decomposed during the process of absorption, the bicarbonate resulting. Like all the organic salts of the alkaline bases, it has *diuretic, diaphoretic, laxative,* and *refrigerant* properties, and also renders the fluids of the body alkaline and corrects the tendency to the formation of uric acid. It is very useful in the milder fevers, such as that of *measles, scarlet fever,* etc., on account of its refrigerant and diaphoretic properties, and its action may be furthered by the addition of appropriate amounts of tincture of aconite root. *Acute rheumatism,* when not of a very severe type, may be treated by it with entire propriety (cf. ALKALIES), and in the *uric-acid diathesis* it is to be preferred to other alkaline organic salts. The usual dose as a refrigerant, etc., is from 20 to 30 grains, and during twenty-four hours as much as an ounce may be administered without ill-effect. It may be given either in plain water or in water to which lemon-juice has been added. More agreeable and equally efficient is the solution of potassium citrate, *liquor potassii citratis* (U. S. Ph.), or neutral or saline mixture, which contains a small amount of carbonic-acid gas and may be given in doses of ½ a fl. oz. The old mixture of citrate of potassium, *mistura potassii citra-*

tis (U. S. Ph., 1880), differed from this solution in being prepared with lemon-juice instead of citric acid, and was of a rather more agreeable flavour. Almost identical with it is an extemporaneous preparation made by dissolving 15 grains of potassium carbonate in ½ oz. of water and adding it to 1 fl. oz. of a mixture of equal parts of lemon-juice and water. Provided the lemon-juice is of the average composition, brisk effervescence should occur, but often a rather larger amount of the juice is necessary. An effervescent granular citrate, *potassii citras effervescens* (U. S. Ph.), is a convenient form in which to employ this salt. It may be given in doses of 1 or 2 teaspoonfuls dissolved in a large amount of water.

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POTASSIUM COBALTONITRITE. — See under COBALT (vol. i, page 273).

POTASSIUM CYANIDES. — For the cyanide and the ferrocyanide, see under CYANOGEN (vol. i, pages 322 and 323).

POTASSIUM HYDRATE. — See POTASSA.

POTASSIUM HYPOPHOSPHITE. — See under PHOSPHORUS.

POTASSIUM IODIDE, KI, *potassii iodidum* (U. S. Ph., Br. Ph.), *kalium jodatum* (Ger. Ph.), when pure, is in the form of colourless cubical crystals of a somewhat unctuous feel, of a soapy, saline taste and a bitter aftertaste, freely soluble in water.

The therapeutic properties of potassium iodide are almost identical with those of iodine, except that they do not include the irritant topical action of iodine (see vol. i, page 535). It is chiefly used in the treatment of so-called *tertiary syphilis*—that is to say, syphilis in the stage of gummata and degenerations of tissue, of deep ulcerations, and of affections of the nervous system, the blood-vessels, the internal organs, and the bones; in short, of syphilis that has passed the period of swollen lymphatic glands, superficial cutaneous eruptions, mucous patches, osteocopic pains, and alopecia. In ordinary cases of syphilis, if the patient is under treatment from the outset and if he is a person of good general health, properly nourished, in good hygienic surroundings, and of good habits, careful treatment with small doses of mercury, prolonged for a period of about two years, may often prove all that is necessary to prevent further manifestations of the disease. If they do occur, they are commonly of a kind to be remedied rather by the use of iodine than by the further employment of mercury. It is then that iodide of potassium becomes the chief remedy at our command. It may at first be given in doses of 5 grains, which may be increased gradually to 8, 10, or 15 grains, three times a day. It should be given in dilute solution, with the addition of articles to palliate its taste and to mitigate any untoward effect it may have on the stomach. The official compound syrup of sarsaparilla is a favourite vehicle for potassium iodide; its agreeable taste commends it, and, in addition, most patients have faith in sarsaparilla as a remedy, so that when they are taking it they have the moral support of feeling that they are doing the right thing.

In the treatment of syphilis, the use of iodide of potassium often requires to be protracted, and ordinarily it is well borne by the system. There are some persons, however, who, by virtue of idiosyncrasy, are affected with iodism. This form of iodine poisoning is considered in the article on IODINE (vol. i, page 535). The opinion has been expressed that iodism occurs far less readily in syphilitics than in persons free from syphilis, and, in accordance with this opinion, the administration of potassium iodide in comparatively large doses, to the amount of 60 grains a day, has been recommended as a diagnostic test in cases in which the syphilitic nature of the disease is questionable—it has been said that if iodism does not occur, the disease may be considered to be syphilis. But this idea seems to be erroneous; the great majority of competent observers who have had ample opportunities of studying the treatment of syphilis maintain that iodism is quite as likely to take place in syphilitics as in other persons, and that therefore the so-called "therapeutic test" is of no practical value. Dr. George Cohen (*Lancet*, July 13, 1895), having remarked the similarity of the phenomena of iodism in patients who were taking potassium iodide to those produced by the inhalation of free iodine, and reflecting on the observed fact that iodide of potassium containing free iodine as an impurity oftener causes catarrh than the pure iodide does, concludes that iodism is due either to iodine being secreted by the salivary glands, or to the circumstance that iodide of potassium is broken up in the mouth after its secretion, and iodine liberated. Hence, he reasons, there is a chance of preventing the continuance of iodism by diminishing the salivary secretion, and he reports his having been able to stop the catarrh in three well-marked cases by adding to the mixture that the patients were taking tincture of *belladonna* to the amount of 10 minims for each dose (10 grains) of the iodide. Iodism is not always a mere matter of catarrh, cutaneous eruptions, and a few other inconvenient occurrences; in rare instances so pronounced is the idiosyncrasy that acute iodine poisoning results. Dr. J. William White, of Philadelphia (*Therap. Gaz.*, December, 1888), cites the record, by Dr. Mackenzie, of a case in which a fatal result followed the administration of a single dose of 2½ grains of potassium iodide to a syphilitic child. The remedy, therefore, should always be used with great caution at first, until it has been ascertained that the patient is not unduly susceptible to its toxic action.

Potassium iodide, as has already been said, is more particularly serviceable in the late manifestations of syphilis. Some physicians have supposed that its remedial action was in great part that of ridding the system of a poison —namely, mercury—that, having been given as a remedy for syphilis, had accumulated in the system. Far from admitting the truth of this explanation, that excellent observer, Dr. Robert

W. Taylor, says in his *Pathology and Treatment of Venereal Diseases*: "Iodide of potassium, administered during or after a mercurial course, lessens at once the quantity of mercury eliminated daily. The practical conclusion to be drawn from these observations is that the iodide is not useful in mercurial poisoning, but, on the contrary, may be harmful. My own experience in the treatment of mercurial stomatitis has convinced me that no benefit whatever results from the administration of iodide of potassium. Clinically, however, it is very frequently found that, the long-continued use of mercury having failed to give relief or having produced a cachectic condition, the substitution of iodide of potassium is followed by involution of the symptoms and improvement of the health. This fact, however, does not warrant the conclusion that the auspicious result was due to any effect produced by the iodide upon mercury supposed to be stored up in the system."

While potassium iodide by itself is more suited to the treatment of the late manifestations of syphilis than to that of the early ones, its association with mercury, in what is called the "mixed treatment," is very serviceable at a comparatively early period—toward the end of the first year, if not before, Dr. Taylor thinks. In his masterly work, already quoted from, he gives the following formulæ for this conjoint of mercury and iodide of potassium:

℞ Mercury biniodide.... 1 to 2 grains;
Potassium iodide..... ½ to 1 oz.;
Syrup of orange peel.. 3 fl. oz.;
Water..... 1 oz.

M. S.: A teaspoonful three times a day, an hour after eating, in a wineglassful of water.

℞ Corrosive sublimate. 1, 2, or 3 grains;
Potassium iodide... ½, 1, or 1½ oz.;
Compound tincture of cinchona..... 2½ fl. oz.;
Water..... ½ oz.

M. To be taken in the same manner as the preceding mixture.

It is in *syphilis affecting the central nervous system* and giving rise to grave symptoms that iodide of potassium assumes its greatest importance as a remedy. "The effect of opium upon pain," says Dr. Edward L. Keyes (*Surgical Diseases of the Genito-urinary Organs, including Syphilis*), "is not more wonderful or more striking than that of the iodide of potassium upon the nervous manifestations due to syphilis." It often has to be used in very large doses for a comparatively short time. It is generally given in such cases in the form of a saturated solution in water, each drop of which contains a grain of the drug. Dr. B. Sachs (Morrow's *System of Genito-urinary Diseases, Syphilology, and Dermatology*) prefers sodium iodide, on account of the unfavourable action of the long-continued use of the potassium salt on the heart. He advises beginning with 10 drops of the saturated solution, given three times a day, in some alkaline water, long enough before meals to insure its complete absorption before anything else is taken into the stomach. According to the patient's condition, he would increase the doses by from 2 to 5 drops daily, until from 100 to 150 drops are taken three times a day, or until the improvement that has set in shows that no further increase of the dose is required. If no improvement has taken place when these large doses are reached, he says, it is well to suspend this form of treatment for a time, but he adds that another attempt should be made in exactly the same way, with small doses gradually increased. He declares that again and again he has seen these renewed attempts finally bring about a decided change for the better in the patient's symptoms. But Dr. Sachs, Dr. Keyes, and Dr. Taylor all insist on the value of mercury also in these cases. "Could we decide with certainty in a given case that the lesion was purely gummy," says Dr. Keyes, "the iodide alone would be all-sufficient, but, as more or less pachymeningitis and arterial disease may be inferred to exist in most cases, it is better to adopt for nervous syphilis a mixed treatment, with the iodide largely in excess." It is hardly necessary to say that when the iodide is being given in large and progressively increasing doses, and mercury is used at the same time, the two drugs should not be associated in one solution, for the doses of the mercurial are not to be increased.

Other grave conditions in which potassium iodide is of notable service, when given in large doses, are *chronic lead poisoning* and *internal aneurysm*. Dr. Bartholow, of Philadelphia (*Practical Treatise on Materia Medica and Therapeutics*), says he knows of several instances in which great benefit was derived from it in aneurysm, and one case certainly in which a cure apparently resulted. The dose in such cases may range from 15 to 30 grains; in chronic lead poisoning, from 15 to 60 grains. *Chronic poisoning with mercury* or *copper* may be treated in the same way. These metallic poisons stored up in the system are rendered soluble by the iodide on its coming in contact with them, so that they are eliminated.

Potassium iodide in the ordinary doses is often of decided service in the treatment of *chronic rheumatism, chronic bronchitis, inflammatory exudates, enlargements of various organs, arterio-sclerosis*, the early stage of *cirrhosis*, and the beginning of *Bright's disease*.

Bicente (*Jour. de clin. et de thérap. infantiles*, March 22, 1894), having successfully treated with the iodide a child suffering from the *acute broncho-pneumonia of measles*, of a suffocating character, which threatened to prove fatal speedily, reflected that, although he had ordered the iodide because the child's father gave a history of syphilis, it might have acted by virtue of some other than its anti-syphilitic property. He therefore resolved to try it in other cases. The result, he declares, has been the same in a large number of cases. He says he has had failures, but they have seemed to him to be in cases of tuberculous disease. He has therefore arrived at the following conclusions: 1. In the simple forms, where there is no tuberculosis, the efficiency of the remedy may be counted upon. 2. If there is no improvement in the course of a few days

its employment should be given up and the existence of tuberculosis inferred. He gives the iodide in daily amounts of from 3 to 12 grains, according to the patient's age. At the same time he uses one or more blisters. The patient's strength should be kept up by means of grog, bouillon, and milk. The caution is given that if after the child has shown decided amelioration, tremulousness and dryness of the mouth are observed, iodism is to be feared.

In veterinary practice, iodide of potassium has been used successfully as a remedy for *actinomycosis*. It was first employed in this disease in Holland, but has since been used in a number of cases in the human subject in France. The results have been so good that M. Netter (cited in *Union méd.*, August 23, 1894) affirms that the iodide is a remedy which assures recovery. The dose need not be very large; M. Netter gives 90 grains a day at the beginning, but rapidly reduces the amount to 45 or even to 30 grains.

Iodide of potassium is sometimes very efficient in *spasmodic asthma*, especially, as Dr. Bartholow states, when the seizures are reflex. In the various manifestations of the morbid constitutional condition called *scrofula*, especially in *chronic enlargements of the lymphatic glands*, the iodides are more or less efficient. In such cases it is well to employ arsenic or iron at the same time, and in many instances cod-liver oil.

As a topical application, potassium iodide is credited with some efficiency as a *sorbefacient*. It is usually employed in the form of an ointment, *unguentum potassii iodidi* (U. S. Ph., Br. Ph.), *unguentum kalii jodati* (Ger. Ph.). The American preparation contains a little sodium hyposulphite; the British, a little potassium carbonate; and the German, a minute amount of sodium thiosulphate. A liniment, *linimentum potassii iodidi cum sapone* (Br. Ph.), is sometimes used.

POTASSIUM NITRATE, *potassii nitras* (U. S. Ph., Br. Ph.), *kalium nitricum* (Ger. Ph.), nitre, or saltpetre, was used formerly much more extensively than it is at present as a *diuretic* and *diaphoretic*. Safer and more efficient remedies have led to the discontinuance of the use of nitre to any considerable extent, save in veterinary medicine. The dose is from 10 to 30 grains. In concentrated solutions it acts as a gastro-intestinal irritant, and numerous deaths have resulted from its accidental ingestion. There is no chemical or physiological antidote for it, and the treatment of such cases must be conducted upon general principles. In *asthma*, the fumes given off during its combustion are often of great benefit, but to distinguish the cases in which it may prove useful is impossible. It is employed in the shape of blotting paper, impregnated with a saturated solution of nitre and dried, which is ignited in a close chamber, and the fumes arising are inhaled. This procedure is entirely safe and should be carried out during a paroxysm.

[Potassium nitrate has recently been recommended as a topical application in the treatment of *burns*. M. Poggi (cited in *Rev. méd.*, February 16, 1896) says it has given excellent results in all kinds of burns of whatever degree. It is used in the form of baths, or in that of compresses wet with a saturated solution. According to M. Poggi, the nitrate acts especially as a refrigerant. As it becomes dissolved in the water it produces a notable lowering of the temperature of the liquid of from 5° to 9° F. If a burned hand or foot is plunged into a basin of water to which a few spoonfuls of the nitrate have been added, the pain ceases rapidly; if the water becomes slightly heated, the pain returns, but it is allayed as soon as a fresh quantity of the salt is added. This bath, which is prolonged to from two to three hours, may bring about the definitive disappearance of the pain and even prevent the production of blisters. The application of the compresses also exercises the same influence. By this means, he says, the pain is allayed and cicatrization takes place without delay.]

RUSSELL H. NEVINS.

POTASSIUM NITRITE. — See under NITRITES.

POTASSIUM OXALATES.—See under OXALIC ACID.

POTASSIUM PERMANGANATE.—See under PERMANGANATES and under MANGANESE (vol. i, pages 596 and 597).

POTASSIUM PHOSPHATE resembles sodium phosphate in its action and has been employed to some extent for the same purposes, in doses of from 10 to 30 grains, but appears to be somewhat inferior to the sodium salt. (Cf. PHOSPHORIC ACID.)

RUSSELL H. NEVINS.

POTASSIUM SILICATE, or soluble glass, was at one time employed internally in the treatment of gout and rheumatism, but at the present time it is used only in the preparation of immovable bandages. (Cf. SILICATES.)

RUSSELL H. NEVINS.

POTASSIUM SULPHATES.—Potassium bisulphate, *potassii bisulphas*, may be regarded as a saline *cathartic*, but is hardly so desirable as the other members of that group. It has a very bitter and acid taste, and may have an injurious effect upon the teeth. An ordinary dose is about 1½ oz. When it is added to a solution of sodium bicarbonate, brisk effervescence occurs, and a mixture of sodium and potassium sulphates will result, but there is no special advantage in their combined employment as cathartics over that of either one by itself.

Potassium sulphate, *potassii sulphas* (U. S. Ph., Br. Ph.), *kalium sulfuricum* (Ger. Ph.), is a gentle *cathartic*, causing little pain or griping and producing watery stools. It is assumed to act beneficially when suppression of the milk is desired, and is often given in fevers and after delivery. The usual laxative dose is from 20 to 30 grains; larger quantities, up to ½ an oz., will act more energetically. It is best given with large amounts of water, as in concentrated solutions it will act as an irritant of the alimentary canal.

RUSSELL H. NEVINS.

POTASSIUM SULPHITE has essentially the same effects as the other sulphites, but in a less marked degree. It may be used in the same doses and for the same purposes as sodium sulphite.—RUSSELL H. NEVINS.

POTASSIUM SULPHOCYANATE has been suggested as a substitute for hydrocyanic acid and the cyanides.—RUSSELL H. NEVINS.

POTASSIUM TARTRATES.—Potassium bitartrate, cream of tartar, *potassii bitartras* (U. S. Ph.), *potassii tartras acida* (Br. Ph.), has an agreeable subacid flavour and is actively *diuretic*, causing the flow of large amounts of urine of low specific gravity, and also *cathartic*, acting as an *aperient* or *hydragogue*, according as the dose is small or large. In *dropsy due to acute nephritis* or *valvular disease of the heart* this salt is probably as effectual a diuretic as any other drug, and its use is practically free from danger. It is best given in the shape of "cream-of-tartar lemonade," which is simply an ordinary lemonade with any desired amount of the salt added, which should previously have been dissolved in hot water. *Potus imperialis* is a solution of ½ an oz. of cream of tartar in 3 pints of water, sweetened and flavoured with lemon peel. Cream-of-tartar whey is the whey strained from milk to which the salt has been added.

In the *febriculæ of childhood* these preparations are quite useful, acting as refrigerants. Combined with sulphur, jalap, or senna, cream of tartar prevents griping and adds to the activity of those drugs. As a *cathartic* it may be employed under the same conditions as the other salines, but is not quite so good as some of them. The dose as an aperient is from 1 to 2 drachms: as a hydragogue, from ½ to 1 oz.; and as a diuretic, 1 drachm, several times a day, in a considerable bulk of water. It is very largely employed to set free the carbonic-acid gas of sodium bicarbonate used for aerating bread, etc., and enters into the composition of the so-called baking powders. It is largely adulterated, and it is best to purchase the crystals rather than the powder.

Potassium tartrate, *potassii tartras* (Br. Ph.), *kalium tartaricum* (Ger. Ph.), is a *laxative* and *purgative*, operating with little pain and causing watery stools. The dose as a laxative is 1 drachm, and as a purgative 1 oz. It is not often used.

Potassium and sodium tartrate, *potassii et sodii tartras* (U. S. Ph.), *soda tartarata* (Br. Ph.), *tartarus natronatus* (Ger. Ph.), or Rochelle salt, is a typical saline *cathartic*, and is probably the least disagreeable of that group to the taste. Usually ½ an oz. will constitute a purgative dose, but in an adult double that amount may be employed without inconvenience. In Seidlitz powders it is the portion contained in the blue or other-coloured paper. In doses of from 20 to 40 grains it is without cathartic effect, and may be employed to induce an alkaline effect upon the system, as in *acute rheumatism*. (Cf. ALKALIES.)

RUSSELL H. NEVINS.

POTASSIUM TELLURATE has been employed as an *anthidrotic*, especially in the *night sweats of phthisis*, in doses of from $\frac{1}{20}$ to $\frac{1}{10}$ of a grain.—RUSSELL H. NEVINS.

POTIO RIVERI (Ger. Ph.) is an effervescent draught made by adding 9 parts of sodium carbonate, in small crystals, to a solution of 4 parts of citric acid in 190 parts of water. It should be freshly prepared when it is to be used. Owing to the carbonic acid that is set free by the action of the citric acid on the sodium carbonate, this solution has a refreshing and slightly stimulant action on the mouth, throat, and stomach; in addition to that, it acts as an alkaline remedy (see ALKALIES). It may be taken freely. The analogous *liquor sodii citratis* of the *Nat. Form.* is made by dissolving 150 grains of citric acid in 16 oz. of water, contained in a bottle, and gradually adding 190 grains of sodium bicarbonate, the solution of which is to be hastened by shaking the bottle, which should be stopped securely at once.

POULTICES, *cataplasms*, *cataplasmata*, "are moist substances intended for external application, of such a consistence as to accommodate themselves accurately to the surface to which they are applied, without being so liquid as to spread over the neighbouring parts or so tenacious as to adhere firmly to the skin" (U. S. Disp.). They are almost invariably applied hot. Although poultices may be made to exert a variety of medicinal actions by the incorporation in them of various drugs—mustard, for example—the non-medicinal or ordinary poultice is made of a substance which has no activity beyond that of warmth and moisture. A number of bland materials are employed in making poultices, and especially flaxseed, but I shall defer the consideration of these ingredients until I come to speak of the several kinds of poultices, at the end of this article. Poultices, like fomentations, afford a convenient means of evoking the remedial powers of moist heat when locally applied; they differ from them, however, in the possession of a more prolonged action.

The application of a poultice is followed by effects which vary with the local conditions. If the part is normal, there will be produced an increase of the cutaneous vascularity, the skin becoming reddened, relaxed, and slightly swollen perhaps. If pain has been present, it will probably have been relieved, the relaxing and soothing power of the moist heat having served to remove pressure from the sensory nerve filaments. If there is beginning *inflammation* in the part, a poultice may serve to check it by diminishing the local tension and relieving the vascular stasis. That this power resides in poulticing is undeniable, but the effect is certainly not invariable, and the application of continuous cold is, both in theory and in practice, a far safer and more efficient procedure, for, by virtue of its warmth and its moisture, the poultice may furnish exactly the conditions suitable for the development of the micro-organisms which are so often present, and thus be a direct cause of the increase of the inflammation. That the conditions might be different if *continuous heat* were furnished

by poultices is possible, indeed, likely, but it is not continuous heat they furnish, but rather warmth. The action of warmth upon acute superficial inflammation, and especially the action of moist warmth, is undesirable, and since we can not, by poulticing at least, maintain that constant and sufficient degree of heat required to restrain superficial inflammation and the activity of micro-organisms, it is better in such cases to employ the more constant and more manageable as well as the less injurious inhibiting influence of cold. With deep inflammations the case is different, however, for then it is not direct warmth and moisture which render poultices efficacious, but that unexplained power they possess, in common with so many other applications, which is known as that of counter-irritation.

If superficial inflammation is well established and exudation, emigration, and pus production have begun, the application of a poultice will, indeed, promote and hasten the process and favour the extrusion of the inflammatory material by softening the tissues which cover it; but, though it will favour "pointing" and the external escape of pus, and though it *may* tend to limit and circumscribe the inflammation, it will, on the other hand, frequently promote the wide diffusion of the inflammation and be the cause of irreparable harm. Especially is this the case when the inflammation is not cutaneous, but is subcutaneous and situated in loose cellular tissue or in the neighbourhood of tendinous sheaths. It is in such cases as these that the employment of poulticing in domestic practice becomes so dangerous, and the widespread popularity of the practice and the general belief in its harmlessness are responsible for many a grave misfortune. To this the experience of every surgeon will bear testimony. If applied to a sluggishly granulating surface, a poultice is said to hasten its healing. No doubt it may, but equally without doubt it may convert that surface into the best of culture media, to the benefit of the micro-organism and the injury of the individual. Poulticing in such cases is certainly not comparable to antiseptic treatment, and poultices, apart from their lack of antisepsis, are not even possessed of asepsis, but may be the means of introducing infection into abraded surfaces. The direct application of poultices to wounds, whether granulating or not, should therefore be forbidden. The *prolonged* application of poultices is highly injurious to the tissues. Under the continued influence of warmth and moisture they become pale, flabby, relaxed, and swollen. Their vitality is greatly impaired, small furuncles frequently appear upon the skin affected, and it is said that sloughing is not an impossible result. The prompt removal of the poultice is, of course, indicated upon the appearance of these atonic conditions, and it may be that stimulant applications will be required to hasten the return of the part to a healthy state.

Apart from the purely local effects of poultices, they are possessed of considerable power as counter-irritants. In spite of all the efforts which have been made to solve it, it must be confessed that we are as much as ever in the dark as to the mechanics of counter-irritation. How the counter-irritant effect of poultices is brought about is unknown, but it is certain that they have an influence over deep-seated inflammations which is pronounced and, indeed, is their most valuable remedial property. It is in inflammatory conditions of the viscera and of the serous and mucous membranes of the thoracic and abdominal cavities that the good effects of poulticing are most striking and the ill effects most unusual. That poultices used for counter-irritant purposes are usually rendered more vigorous in action by the addition of rubefacient remedies to them is true, but the addition is not essential, for even without it the poultice is in itself a counter-irritant of considerable activity. It may be that a constitutional influence will result from the abuse of poulticing if it is extensive, and general relaxation and atony, with circulatory enfeeblement, may be attributable to it.

The therapeutics of poulticing will have been inferred from what has already been said. In *neuralgic pain* it may be an efficient means of relief, but as its efficiency in these cases is probably dependent upon a counter-irritant action, the addition of rubefacients is common, and the use of the simple emollient poultice is unusual. As a means of softening *cutaneous incrustations* preliminary to their removal, the emollient poultice of flaxseed is in frequent employment. *Eczematous incrustations* in particular are so treated. In *superficial inflammations* the use of poulticing should be cautious in the extreme, and the dangers which have already been stated should ever be borne in mind. In acute congestive and inflammatory conditions of deep-seated structures lies the chief utility of poulticing. Thus *pleurisy*, *pericarditis*, and *bronchitis* may well be treated. *Pneumonia* may be treated in the same way, though it is doubtful whether anything more will be obtained from poulticing than a beneficial action upon the pleurisy and the bronchitis which are present, for it is not likely that the procedure will exert any influence upon the consolidation. The effect of poulticing in pneumonia is not a subject upon which all physicians are agreed; many think it distinctly prejudicial to recovery. In all thoracic, and indeed in abdominal, conditions, too, the effect of poulticing is more apparent when the parietes are thin. In children, therefore, as a rule, poulticing is a more vigorous remedy than in adults. In *acute abdominal congestions* and *inflammations* the use of cataplasms is of much benefit. *Intestinal* and *hepatic inflammations* may thus be relieved, and even *peritonitis* is favourably influenced. In all these conditions the poultices should be of ample dimensions, and in case the abdominal disease is general, the application should be made to cover the abdomen completely. In general peritonitis the cataplasm should be made as light as possible, on account of the extreme tenderness which is present as a rule. In *pelvic peritonitis* and *localized abdominal inflammations* this precaution, as a rule, is not so requisite. *Lumbago* and other *myalgias* are

benefited by poulticing, no doubt, but the sinapism is usually a far more suitable application. Lumbar poulticing for the relief of *renal congestion* and consequent *suppression of urine* is a procedure of great value. The use of poultices in *articular inflammation* is not to be recommended, as a rule, save of that known as the "dry poultice," which consists of a wrapping in cotton with an outer covering of rubber tissue or similar material to retain the heat. This form of application may, indeed, be beneficial, but the emollient poultice of flaxseed is apt to promote articular exudation and to favour the production of pus, perhaps to the permanent injury of the joint. A service which poultices are sometimes called upon to render is to promote the specific action of medicinal applications. To this end the remedy may be sprinkled upon the surface of the poultice, as is frequently done with laudanum, or the medicament may be applied to the skin and the poultice superimposed upon it. Thus belladonna is used, and for the relief of painful and inflammatory conditions Ringer recommends the application of a mixture of equal parts of extract of belladonna and glycerin beneath the poultice. No doubt this procedure is efficient, but the application of belladonna to the skin must always be carefully made, for absorption sufficient to cause pronounced and even dangerous effects is always a possibility, especially when the area of application is extensive or the skin broken, and doubtless, too, absorption would be more active under the influence of warmth and moisture.

Certain general rules apply to the employment of poultices. The poultice should be applied as hot as may well be borne. The determination of this temperature may be left to the patient himself in case he is in possession of his normal faculties. If he is insensible, however, or if his general or local sensibilities are blunted, the attendant must determine the safe and proper temperature of the poultice by applying it to a part of his own skin which is sufficiently sensitive. A neglect of this precaution may result in dangerous blistering or burning. One of the chief disadvantages of poulticing is the fact that the application so soon cools and thus loses its efficiency. To prevent this tendency, so far as is possible, a heat-retaining substance should always be placed over the poultice. Cotton may be sufficient for this purpose, flannel may also be used, but a more reliable substance is oiled silk. Notwithstanding these precautions, the heat of poultices is soon lost, and it becomes necessary to renew them frequently. The frequency with which this should be done will vary, of course, with the rapidity of cooling, and this in turn will vary with many circumstances. An interval of two hours, however, may be said to represent the average time of utility of poultices. In changing the poultice, it should be seen to that the skin is not left unprotected even for the shortest time, for in its relaxed and hyperæmic condition it is extremely sensitive to the injurious influence of cold. For the same reason, the skin should be carefully protected after the use of poulticing has been suspended. Poultices may dry and adhere to the skin if left too long upon it; they may also cause a considerable amount of irritation. To prevent such occurrences, it is well to smear the area of application with vaseline, or glycerin may be used in its stead. The size of poultices should always be generous, for no harm will result from the use of large rather than small ones, save when the treatment is long persisted in, and in many cases, especially when poultices are employed as counter-irritants in thoracic and abdominal inflammations, the beneficial results are in proportion to the amplitude of the application. For this reason, in such conditions as bronchitis and pneumonia, especially in children, in whom it is difficult to maintain the proper position of the poultice, there is used what is known as the *poultice-jacket*. This is a sleeveless jacket of muslin which is made of two layers of the cloth sewed together at the edges. Thus, it is practically a bag in which the poultice material (flaxseed, usually, mixed with hot water) is placed, sagging of the poultice being prevented by the insertion of quilting stitches here and there, and apposition to the body being obtained by tapes which fasten the jacket together in front as well as over the shoulders.

Indications and contra-indications are seldom to be accepted unreservedly, for all cases are subject to alteration by circumstances. As a general statement, in the case of poultices, however, it may be said that they are indicated as mild counter-irritants in acute congestive and inflammatory conditions of the thorax and abdomen, and are strongly contra-indicated in all superficial congestions and acute inflammations where pus formation is a possibility.

The Flaxseed, or Linseed, Poultice, *cataplasma lini* (Br. Ph.), is a mixture of linseed meal with boiling water. The official directions for making it require 2 parts of the former and 5 fluid parts of the latter. These are gradually mixed, with constant stirring. In practice no such accuracy of measurement is required, and it is sufficient to combine the ingredients in such proportions that a pultaceous mass, neither too fluid nor, on the other hand, too stiff, shall result. Linseed is more used for poultice-making than any other material, for its oily and mucilaginous constituents make it thoroughly useful and, because of its cheapness, it is generally obtainable. In making the poultice, it should be seen to that all the ingredients and apparatus employed are warmed, else the poultice when completed will be but warm instead of being hot. A bowl having been warmed, there is poured into it a sufficient amount of hot water, and to this there is added flaxseed meal, little by little, with constant stirring, until a smooth and sufficiently consistent dough results. This is quickly spread upon a thin cloth which is of sufficient size to permit of being turned up about the edges of the mass and made to cover its back. The cloth having been adjusted and fastened, the poultice is ready for application. The thickness with which the poultice material is spread will vary between half an inch and

an inch, the former thickness being more suitable where lightness is required, and the latter advantageous because it longer retains the heat.

Bread Poultices are frequently employed in the same cases in which linseed poultices are used. They are made preferably from stale bread thoroughly disintegrated and rubbed up with hot water. Instead of hot water, hot milk may be employed, the "bread-and-milk" poultice being the result. The disadvantages of all bread poultices are that they cool quickly, dry quickly, crumble, and are apt to become sour.

Indian-meal Poultices are prepared from Indian (maize) -corn meal in the same manner as flaxseed poultices are. They are popularly supposed to retain their heat for a longer time than flaxseed poultices, and in this opinion Dr. H. C. Wood concurs.

Bran Poultices are serviceable because of their lightness. Their preparation and their uses are the same as those of the poultices already mentioned.

Poultices are prepared also from oatmeal, from slippery elm, from mashed potato, from carrots boiled and mashed, and from starch.

The Charcoal Poultice is prepared by adding powdered charcoal to the ordinary flaxseed poultice or by dusting it upon the surface of the poultice, or by doing both. The official poultice, *cataplasma carbonis* (Br. Ph.), consists of 1 part of powdered wood charcoal, 4 parts of bread crumb, 3 parts of linseed meal, and 20 fluid parts of boiling water. The bread is macerated in the water for ten minutes near the fire and then mixed, and the linseed meal is gradually added, with constant stirring. With this there is mixed one half of the charcoal, and the remainder is sprinkled upon the surface of the poultice. The charcoal poultice is thought a suitable application to *offensive ulcers*, but another method of applying the charcoal is to be preferred (see CHARCOAL), and of the objections to poulticing ulcers enough has been said.

The Yeast Poultice is misused in the same way. It may be made by smearing warm yeast on the surface of a bread poultice. The official yeast poultice, however, *cataplasma fermenti* (Br. Ph.), is practically nothing more than rising dough; it is composed of 3 fluid parts of beer yeast, 7 parts of wheat flour, and 3 fluid parts of water heated to 100° F. The yeast is mixed with the water, the flour is stirred in, and the mass is placed near the fire until it rises.

An Iodide-of-Starch Poultice has been recommended to cleanse unhealthy and sloughing ulcers. A jelly is made by the combination of 2 oz. of starch and 6 oz. of boiling water, and to this is added, before cooling takes place, ½ oz. of liquor iodi (Br. Ph.). This mixture is spread upon cloth and applied cold.

The Mustard Poultice is made by the addition to the flaxseed poultice of mustard in amounts which vary with the rubefacient impression which is desired. As a counter-irritant for the relief of *deep inflammations*, it is an application of much value. The official mustard poultice, *cataplasma sinapis* (Br. Ph.), contains 2½ oz. "or a sufficiency" of powdered mustard, 2½ oz. of linseed meal, and a sufficiency of boiling water and of lukewarm water. The mustard is mixed with from 2 to 3 oz. of lukewarm water, the linseed meal is mixed with from 6 to 8 oz. of boiling water, and the two mixtures are united by stirring.

The Chlorine Poultice, *cataplasma sodæ chlorinatæ* (Br. Ph.), contains 1 fl. part of solution of chlorinated soda, 2 parts of linseed meal, and 4 fl. parts of boiling water. The linseed meal is gradually mixed with the water and the solution of chlorinated soda is stirred in. This poultice is designed for the destruction of offensive gaseous emanations from *unhealthy sores*. Chlorinated lime may be used in the same way. The use of poulticing in such cases is usually highly undesirable.

Various medicinal additions are made to poultices for the object of thus obtaining the specific local effect of certain drugs. Of such additions, save rubefacients, it may be said that in general they are unwise, the application of active medicinal agents being more suitably practised by the use of ointments, plasters, and similar means. Opium, however, generally in the form of laudanum, may be sprinkled upon a poultice when relief of pain is an urgent necessity, but a hypodermic injection of morphine is more accurate and reliable and much to be preferred. A hemlock poultice, *cataplasma conii* (Br. Ph.), is sometimes employed (see CONIUM).

As a substitute for the ordinary emollient poultice, there is sometimes employed a material known as *spongiopiline*. This is a heavy fabric upon one side of which sponge, in very small pieces, is felted in and the surface then shredded so as to form a nap, while the other side is covered with a layer of rubber. If the sponge side is moistened and the material is applied, we have present all the elements of a poultice, for both the heat and the moisture are retained by the rubber backing, though it must be confessed that cooling soon takes place. Spongiopiline is little used at the present time.—HENRY A. GRIFFIN.

POWDERS.—In a pharmacopœial sense, a "powder" is a medicine or mixture of medicines directed to be kept on hand or to be put up in a certain form ready for dispensing. When powders are prescribed *ex tempore*, regard should be had to the nature of the substances composing them and to the purpose for which they are intended. If they are composed of several ingredients, and intended for internal use, they should be in a state of fine division and intimately mixed. If one or more of the ingredients is an unusually potent substance—for instance, arsenous acid—the greatest care must be taken to insure its uniform distribution through the mass.

If a compound powder is intended for external use, as for dusting wounds, it is preferable not to mix it by trituration, since this is apt to render it too compact, but to mix it on paper with a spatula, and then to pass it repeatedly through a sieve.

When a powder is prescribed which is apt to deliquesce, it should be dispensed in glass, or, if the case admits of it, in paraffin paper.

Sometimes potassium chlorate or hypophosphite is ordered in powder in combination with sugar or with tannic acid or some other organic substance. If these were triturated together in a mortar, a dangerous explosion would be apt to result. The ingredients should therefore be powdered separately, and then carefully mixed, without trituration, on a sheet of paper.

Occasionally substances are prescribed together with the intention of having them dispensed as a powder, although they do not permit of this. For instance, if chloral is rubbed with camphor a liquid will result. The same happens when antipyrine is triturated with chloral, naphthol, sodium salicylate, etc. Acetate of lead and sulphate of zinc are often prescribed together. On triturating them a white paste will form, due to the separation of water from the zinc sulphate and the simultaneous formation of sulphate of lead.

A very convenient way of administering powders, if they are not too large, is by means of empty capsules or in wafers. (See WAFERS. Cf. INSUFFLATION.)—CHARLES RICE.

PRESCRIPTIONS are written orders from the physician to the pharmacist, instructing him to dispense a remedy or a combination of remedies in such amount or proportion as the physician may see fit, and generally including the written directions which the pharmacist is to place upon the receptacle which contains the medicament when it is dispensed. The form which a prescription should follow is too well known to require description in such a work as this. The language in which prescriptions are written may, with propriety, be the vernacular, but, since certain advantages pertain to the use of Latin, that is the language most commonly employed. These advantages are the fact that Latin is recognised as the language of science the world over, so that a prescription properly written in Latin may be comprehended and properly dispensed by a pharmacist, whatever his nationality; the fact that Latin names are constant and definite, while vernacular names have various applications and are subject to change; and the fact that Latin affords a means of prescribing without the patient's knowing the nature of the drugs he is to receive. That this last advantage is not a great one is perhaps true in the case of the more highly educated patient, but with the multitude it is certainly effective, and that the patient should in many cases be ignorant of the nature of his medicine is almost self-evident. The directions for the patient which the compounder is to place upon the receptacle in which the medicine is dispensed are usually written in the vernacular, since no advantage, as a rule, would result from having them in Latin. The directions to the compounder, however, are usually written in Latin.

So far as the writing of prescriptions is concerned, it is a thing which ought to be performed with much care and thoughtfulness. That the writing should be legible might go without saying, but in this respect the physician is often culpable. Abbreviation, too, is a serious fault in prescription-writing, and often dangerous in a high degree. Many drug names may be safely abbreviated, but others when abbreviated become ambiguous and easily confounded, so that it will be far safer, and, certainly, more elegant, if the prescription is written in words which are entire. Of dangerous abbreviations many examples might be cited—for instance: "acid. hydroc. dil.," which might be interpreted as meaning either acidum hydrochloricum dilutum or acidum hydrocyanicum dilutum, remedies certainly of widely different potentialities. To give a list of such abbreviations which should have any claim to completeness would require too much space, but a very satisfactory list of examples may be found in Thornton's *Dose-Book and Manual of Prescription Writing*. That serious mistakes are so seldom attributable to illegible writing and abbreviation is not so much to be credited to the physician as to the pharmacist, whose duty it is to obtain elucidation from the prescriber whenever ambiguity or uncertainty is aroused by a prescription. It is perhaps the knowledge that the prescription will be critically scanned by the pharmacist that makes the physician less careful than he should be. Such carelessness, however, should be severely reprehended, for a mistake may escape the eye of the pharmacist as it has escaped that of the physician, and then both become blameworthy. The condition is the same with incompatibility. So far as chemical incompatibility is concerned, the pharmacist is no doubt more expert than the physician, but to the practitioner of any experience it is certainly discreditable that he should prescribe remedies in combination which are chemically antagonistic; of physiological antagonism he should be by far the better judge than the pharmacist, and should know to what degree a therapeutical incompatibility may exist in his prescriptions. To some degree, physiological and therapeutical antagonism is often sought for by the prescriber, that one remedy may diminish or correct the over-activity of the principal agent in the prescription, but this antagonism is intended and is not the complete antagonism which is, as it were, antidotal. Of solubilities, the prescriber should be well informed, that unsightly medicine shall be avoided so far as is possible. It must not be forgotten, too, that a precipitate or sediment may be taken with the last doses in the bottle, and thus make them dangerous overdoses, and this perhaps in spite of the direction to "shake well before taking." The success of a practitioner often depends upon little things, and among them the prescribing of medicines of good appearance, which are, so far as possible, agreeable to the smell and taste, is not the least.

The prescription should, as a rule, call only for such quantities of medicine as will be required by the patient during a very limited time, for renewals are generally easily obtained. On the other hand, it is absurd to prescribe a large quantity of medicine from which but a

small amount can be consumed; moreover, the habit which many people have of retaining and storing up their unemptied bottles of medicine is both foolish and dangerous, for deterioration as well as concentration may occur, to the injury of the patient who may eventually partake of his stock rather than have a new supply compounded. The question of repeatedly dispensing medicines on one prescription is one which must be borne in mind by the physician. Many prescriptions are intended only for brief employment and may contain ingredients whose continued use would be undesirable. Under these circumstances the prescriber should write upon his prescription "Not to be repeated," or words to a similar effect, for it is second nature to the patient to indefinitely renew the supply and continue to use the medicine which affects him favourably or pleasantly, without thought or knowledge as to consequences. Of no prescriptions is this truer than of those which contain anodynes and hypnotics. As to doses, it is self-evident that the prescriber should exercise great care. The pharmacist, it is true, stands between him and the patient, but that should not in the least lessen his responsibility, and carelessness in dose determination and prescription may mean loss of life or loss of reputation, perhaps both. In some cases doses of unusual size are made necessary by unusual circumstances, and various plans have been proposed by which the prescriber may inform the dispenser of the correctness of the unusual amount. Such is the drawing of a heavy line beneath the quantity and the remedy, the expression of the quantity both in the Roman and in the Arabic characters or in the English and metric systems, the addition of an exclamation mark (!) after the dose, or the insertion of the letters Q. R. (*quantum rectum*). None of these is in general employment, however, and it generally happens in such a case that a question from the dispenser and an answer by the prescriber are gone through with. In the determination of doses the physician will be governed by many circumstances, but these have been presented elsewhere (see DOSES). In ordering quantities, nevertheless, it must ever be borne in mind that measures of accuracy are demanded in prescriptions; drops, teaspoonfuls, tablespoonfuls, and wineglassfuls may be allowed in the directions to the patients, because of the previously considered and reckoned latitude of doses, but no such measures should occur in the body of the prescription.

In writing a prescription the active agent or agents should first be selected. This portion of the prescription is known as the basis. The basis should include as few remedies as may be, and if a single remedy will serve, so much the better. If several different effects are to be accomplished, it is far better to prescribe a corresponding number of individual remedies than the same number in combination, for results may then be more perfectly judged of and conclusions drawn. Two and even more remedies, however, may unite to do a work which one alone will do but imperfectly; for this reason arsenic and iron are often combined. Under these circumstances the several ingredients may wisely be mixed and given together, but the piling together of many remedies, in the hope that, if one does not relieve, one of the others may, is unscientific guesswork, and a prescription so constructed has well been dubbed "shotgun." To aid in the action of the basis there may be incorporated what is known as an adjuvant. The aid may be chemical, such as the effecting of solution, or it may be physiological and promote the remedial effect. Thus, calomel will promote the diuretic effect of digitalis. Diminution of a disagreeable or undesired effect of the basis may be obtained by the addition of another remedy to it. This is known as the corrigent, and an example is had in the diminution or the abolition of griping which results from the use of some of the resinous purgatives by the addition to them of an antispasmodic or an aromatic. Finally, the excipient, or vehicle, in case the medicine ordered is liquid and intended for internal use, may be so sweetened or flavoured as to make the preparation more acceptable both to the palate and to the stomach. This flavouring and sweetening are not always necessary, but will be determined by the nature of the drugs employed. In solid preparations the taste of the excipient is, of course, of less importance. Medicinal prescriptions, therefore, may consist of a basis, an adjuvant, a corrigent, and a vehicle. Concerning the substances so used information will be found in other parts of this work, and special preparations, such as emulsions, pills, etc., are elsewhere considered.

The ownership of the prescription is a much discussed matter—more discussed, indeed, than the question would seem to deserve. The decision is even yet not finally reached, but the custom of the majority of pharmacists is to retain the original prescription as evidence in case of subsequent dispute, while they give copies of it (copies having no legal status) to those concerned.—HENRY A. GRIFFIN.

PROPYLAMINE.—See TRIMETHYLAMINE.

PROTONUCLEIN.—See under NUCLEINS (vol. ii, page 21).

PRUNES.—The fruit of *Prunus domestica* is official as *prunum* (U. S. Ph., Br. Ph.). It enters into the composition of confection of senna. Stewed prunes, taken at meals like other sweets, are often efficacious in overcoming *constipation*, provided it is of a mild degree.

PRUNUM.—See PRUNES.

PRUNUS VIRGINIANA (U. S. Ph.) is the bark of the wild cherry tree of North America, *Prunus serotina*. It is *tonic* and mildly *astringent*, and is popularly regarded as an efficient *pectoral* and *sedative*; on this account it is much employed to allay *cough* and, by reason of its agreeable flavour, is a favourite addition to cough mixtures. The infusion, *infusum pruni virginianæ* (U. S. Ph.), is occasionally employed as an astringent lotion. It may be given internally in doses of from 2 to 3 fl. oz., three or four times a day. The dose

of the fluid extract, *extractum pruni virginianæ fluidum* (U. S. Ph.), is from 20 to 40 drops; that of the syrup, *syrupus pruni virginianæ* (U. S. Ph.), is from 1 to 2 fl. drachms. The fluid extract and the syrup are much employed for imparting a pleasing flavour to insipid liquid medicines.

PRUSSIC ACID.—See HYDROCYANIC ACID.

PSEUDACONITINE is an alkaloid obtained from *Aconitum ferox*, Indian aconite. It is a crystalline substance, and from it crystalline salts may, with difficulty, be obtained. Pseudaconitine melts at about 220° F. If dehydrated, it produces *apopseudaconitine*, and from its saponification there is obtained *pseudaconine*. It is said to be related to the alkaloids narceine, narcotine, and oxynarcotine, which are derived from opium. The formula of pseudaconitine is $C_{36}H_{49}NO_{12}$. It is sometimes erroneously called aconitine.

The physiological action of pseudaconitine is similar to that of aconitine (see ACONITINE). Though the relative potency of the two alkaloids has not been finally determined, pseudaconitine is certainly violently poisonous. Pseudaconitine is not used medicinally, and as yet we are but ill informed of its properties. Perhaps like *Aconitum ferox*, from which it is derived, it differs from the alkaloid of *Aconitum napellus* in being more of a diuretic and less of a diaphoretic.—HENRY A. GRIFFIN.

PTEROCARPUS.—See SANDALWOOD.

PTISANS.—See DRINKS.

PTYALAGOGUES.—See SIALAGOGUES.

PTYALIN.—This amylolytic constituent of the saliva is in the market in the shape of a yellowish powder, also in the form of a solution in glycerin. It has been used to some extent as a remedy for that form of *dyspepsia* in which starchy articles of food are particularly difficult of digestion. The dose is from 10 to 30 grains. Mixed with pepsin, forming Merck's "ptyalin-pepsin," it may have a wider range in the treatment of dyspepsia.

PTYCHOTIS AJOWAN.—See AMMI.

PULSATILLA (U. S. Ph.) is the herb, collected soon after flowering, of *Anemone Pulsatilla* and of *Anemone pratensis* (pasqueflower, meadow anemone), small herbal plants of the *Ranunculaceæ*. The first is a very common plant in England, northern Europe, and Siberia; the second, also called *Pulsatilla nigricans*, inhabits southern Europe. A third species, *Anemone patens*, var. *nuttalliana*, inhabits the United States. The herb should be carefully preserved, and not kept longer than a year; even the drying of it is said to impair its medicinal value and render it unreliable. The dose of the herb is from 1 to 5 grains.

The pulsatilla plants, when fresh and distilled with water, yield a distillate from which ether extracts an acrid, yellow oil. This oil, in the presence of water, is gradually converted into anemonin and anemonic acid. *Anemonin*, or pulsatilla camphor, $C_{15}H_{12}O_6$, the active principle of the plant, is crystallizable and very volatile, soluble in chloroform and in hot alcohol, almost insoluble in water and in ether. The dose is from $\frac{1}{6}$ to $\frac{1}{3}$ a grain, in pill; much larger doses, $1\frac{1}{2}$ grain, may be taken without inconvenience (Vigier); doses of 2 grains produce no physiological symptoms in man (Clarus, Schroff); 9 grains have proved fatal to rabbits in three or four hours (Clarus). It is very unstable. *Anemonic acid*, $C_{15}H_{14}O_7$, obtained from anemonin by the action of alkalies, is a white, crystalline, tasteless powder, apparently inert.

The herb alone is official in the United States. The dose is from 1 to 5 grains. A tincture may be prepared according to the official formula for tinctures of fresh herbs (*tincturæ herbarum recentium*) by using 1 part of the freshly-gathered herb, bruised and crushed, and 2 parts of alcohol. The dose is from $\frac{1}{10}$ to 5 minims, several times a day. The imported German homœopathic tincture, made with equal parts of the expressed juice and of alcohol, is an efficient preparation, but tinctures or fluid extracts made from the imported dried plant are not trustworthy. The Ger. Ph. formerly had an extract, to be given in doses of from $\frac{1}{2}$ to 3 grains, but it was unreliable; and the Fr. Cod. has an alcoholate, which is practically a strong tincture, made from the fresh herb.

Locally used, pulsatilla is powerfully irritant—the oil vesicates the skin, and the fresh juice causes tingling and burning sensations in the part to which it is applied. It may excite a violent dermatitis, with a vesicular or pustular eruption; and inflammation and even gangrene of the entire limb has followed the application of the bruised root to the calf of the leg for rheumatism. Inhalation of the dust has produced itching of the eyes, colic, vomiting, and diarrhœa; the fresh herb, swallowed, may cause severe irritation of the gastro-intestinal mucous membrane. On the tongue, the fresh juice gives rise to tingling and burning followed by numbness—symptoms caused also by aconite. Internally administered, it is *diuretic*, *diaphoretic*, and *emmenagogue*, and acts as a *cardiac* and *vascular sedative*, lowering the action of the heart, the arterial tension, and the bodily temperature. In overdoses it strongly affects the mucous membranes, giving rise to nausea and vomiting, slimy diarrhœa, bloody urine, profuse and offensive sweats, coryza, and cough, also vesicular and pustular eruptions on the skin, and peculiar pains in and dimness of the eyes (Dierbach, Dietz, Clarus). It acts by controlling irritability and overactivity of the ganglionic nervous system, and has no title, except indirectly, to be classed with hellebore and aconite as a vascular sedative (Shapter). Large doses paralyze the spinal cord and the medulla oblongata (Clarus). Its primary action is that of a spinal irritant; its secondary results are exhaustion and general paralysis (Tully). It is a paralyzer of motility and sensibility (Bartholow). The homœopathic writers credit it with specific influence on the synovial membranes, the veins, the ears, and the generative organs of both sexes (Hughes). The pharmacology of the drug is yet to be accurately worked out.

The action of anemonin has been studied by Heyer, Clarus, and others, chiefly on rabbits, since its discovery, in 1771, by Störck. Applied to the conjunctiva, it caused slight inflammation; on the human tongue it left a slight burning sensation. Melted, its vapour produced intense inflammation of the eyes, and caused pricking in the tongue, followed by numbness and white patches. The symptoms following its internal administration in fatal dose were a slow and feeble pulse, slow respiration, lowered bodily temperature, frequent diarrhœa, paralysis of first the hind and then the fore legs, dyspnœa, mydriasis succeeded finally by meiosis, stupor, and death without convulsions. The absence of convulsions is thought to be due to a paralyzing action of anemonin on the cerebral motor centres, as in poisoning by extract of pulsatilla they are always present. The autopsy showed congestion and œdema of the lungs and marked hyperæmia of the cerebral and spinal membranes, especially in the vicinity of the medulla oblongata. The heart walls were relaxed, and its cavities and the great vessels were filled with dark, clotted blood, while the blood elsewhere was fluid. The liver, spleen, kidneys, and other abdominal viscera were found healthy.

Antagonists and Incompatibles.—Alcohol, opium, and digitalis are its physiological antagonists. Tannic acid, the caustic alkalies, and the metallic salts are chemically incompatible with preparations containing pulsatilla or anemonin.

Therapeutics.—The medical history of pulsatilla ascribes to it somewhat of the character of a panacea, so numerous and diverse are the affections reported to have been cured with it. The ancient writers credited different species of anemone with many medicinal virtues, but the modern use of this drug dates from the time of Baron Störck and his contemporaries (1770 to 1800), who highly praised *Pulsatilla nigricans* as an efficient remedy for corneal opacities, cataract, paralysis, rheumatism, amenorrhœa, melancholia, secondary syphilis, old ulcers, and scaly skin diseases. Later therapeutists differ widely as to its medicinal value, some finding no efficacy in it and others giving it extravagant praise. In *acute catarrhal affections* of mucous membranes it has been very efficient, particularly in *rhinitis* and *conjunctivitis*, the early stage of *purulent ophthalmia* in children, and gonorrhœal *ophthalmia*, also in *subacute* and *chronic bronchitis* of delicate persons accompanied with much mucous expectoration, and in *chronic catarrh of the bladder*. It is used with benefit in *chronic nasal catarrh* with a thick though bland discharge, and even when the discharge is offensive; also in *acute* and *subacute inflammations of the middle ear* and of the *external auditory canal* so often seen in children, where the lining membrane is red and swollen, with severe pain, and later on a thin, acrid discharge appears, often bloody and soon becoming puriform. In these affections medium doses (from 5 to 10 minims of the tincture) are given internally every four hours to adults; also from 1 to 2 fl. drachms in from 4 to 6 oz. of warm water may be applied as a lotion to parts which are accessible. A similar use of this remedy has proved of benefit in many cutaneous affections, especially *eczematous eruptions*, *syphilides*, and *indolent ulcers*.

In *acute* and *chronic dyspepsia*, characterized by *gastric catarrh* or *subacute gastritis* with a white-coated tongue, no taste or a greasy one in the mouth, nausea, flatulence, heartburn, sick headache, anorexia, depression, diarrhœa, etc., pulsatilla proves a very efficient remedy in 5-drop doses of the tincture every four hours. It does good service also in *intestinal catarrhs*, shown by passive, mucous diarrhœa with little pain, and frequently seen in the febrile affections of childhood, especially in measles, mumps, varicella, and remittent fever.

On the generative organs of both sexes pulsatilla is generally credited with a specific action, both physiologically and therapeutically. *Epididymitis* and *orchitis* have been often controlled and entirely dissipated within a few days by very small doses, a few drops of the tincture in a glass of water, of which a teaspoonful is given every two hours (Piffard, Sturgis). In more than twenty-four cases of acute uncomplicated epididymitis, doses of 2 drops every two hours gave immediate relief, the patients not being confined to bed, but wearing a suspensory bandage (Borcherin). Doses of 5 drops aggravated this disorder, while those of $\frac{1}{10}$ minim every three hours proved curative (Piffard). In *functional amenorrhœa*, *scanty* or *delayed menstruation*, and in *suppression of the menses* from fright or chill, in *oophoritis*, and in simple *mucous leucorrhœa* with pains in the back and nervous depression, it has been found an excellent remedy. *Dysmenorrhœa* has been removed in several cases by 2-drop doses of the tincture thrice daily for several days before the menstrual epoch (Piffard). Extravagant opinions of its virtues in the puerperal state and during parturition are promulgated by homœopathic authorities, who even credit it with the power of rectifying false presentations in labour by causing spontaneous version of the child and bringing the head to present.

Besides catarrhal affections of the ocular mucous membrane, already mentioned, pulsatilla has a remedial power in certain affections of the eyelids. It is believed to blight a *stye* when given internally, though not to prevent its recurrence. In recent *blepharophthalmia*, the lacrymation and Meibomian secretion being profuse, it is an efficient remedy, and is said to stop twitching of the lids accompanied by dazzling of the sight. It has been efficiently employed in the *earache* of children and in recent *catarrhal deafness*, also in *acute cerebral* and *spinal meningitis*, *eclampsia* from various causes, *asthma*, *subacute rheumatism* of the small joints, *acute rheumatic gout*, left-sided *clavus*, *hemicrania*, and *inframammary pain*. Deniau used it with benefit in several nervous affections, and concludes that it is a direct sedative of nervous irritability, but only indirectly a vascular sedative. Tucker found it to be especially serviceable for *nervous headache* produced by overtaxing the mind. An extract of

the root has proved efficient against *tapeworm*. *Coughs* which are loose by day but dry and tickling on lying down at night are greatly benefited by small doses of the tincture frequently repeated; and anemonin, in doses of ¼ to 1 grain, has been found extremely useful in *whooping-cough* and other *irritative coughs*.

SAMUEL O. L. POTTER.

PUMILINE.—See under PINE PREPARATIONS (vol. ii, page 88).

PUMPKIN SEED.—See PEPO.

PUNICA, PUNICINE.—See PELLETIERINE.

PUNK.—See under AGARIC.

PURGATIVES.—See CATHARTICS.

PUSTULANTS.—See under COUNTER-IRRITANTS.

PYOCTANINE is a name applied to two distinct aniline dyes which possess *antiseptic* properties. One, known also as methyl violet or methyl blue, may be a tetramethyl, a pentamethyl, or a hexamethyl pararosaniline, or perhaps a mixture of methyl pararosanilines in various proportions. Arsenic is frequently present as an impurity. The other variety, the yellow, is one of a group of aniline dyes known as auramines. It is said to be free from arsenic. The blue pyoctanine is considered the more powerful, is the one employed in general surgery, and is the variety usually referred to when the word pyoctanine is used without a qualifying adjective. Yellow pyoctanine is principally used in ophthalmic practice.

Pyoctanine occurs in the form of paste or crystals, of the colours indicated, and is odourless. According to the bacteriological experiments of Fessler and of Trojé, it would seem to be a germicide, although these observers differ very materially in regard to its power. Fessler maintained that pyogenic micro-organisms were destroyed in fifteen minutes by exposure to a 1-to-1,000 solution, while Trojé found that those micro-organisms were not certainly destroyed after twelve hours of such exposure. Pyoctanine does not coagulate albumin.

According to Combermale, pyoctanine has, when given internally, two principal actions, one local and strongly irritant, the other characterized by sedation of both motor and sensory nerves. It occasionally, though not frequently, causes gastro-intestinal irritation, it is rapidly absorbed into the circulation, and it is excreted by the kidneys, upon which it acts as an irritant. Soon after the administration of a dose the drug appears in the urine, which it renders at first bright green in colour, after two hours dark green, and after four hours dark blue. If the dose is repeated two or three times a day, the urine becomes sterilized and will resist putrefaction for two or three weeks. The *sedative*, or rather *analgetic*, property of the drug has been demonstrated, so far as demonstration is possible of the properties of a drug of uncertain composition, and two theories have been advanced to account for it—one, that it depends upon an elective affinity of the drug for the axis-cylinder of the nerve; the other, that a condition of methæmoglobinæmia is produced and that, as a secondary result of this, nervous irritability is diminished.

Pyoctanine is said to have affected the heart so as to cause intermittence of the pulsations, but such an effect has not generally been noticed. The toxic symptoms deduced by Orloff from his experiments on dogs and horses are dilatation of the pupils, severe salivation, muscular tremor, and vomiting. Fortunately, we have few data in regard to these symptoms in addition to those obtained by such experiments.

Pyoctanine is principally and best known as an antiseptic dressing. The surgical world was electrified by the announcement of Stilling, of Strassburg, that he had discovered an ideal germicide, superior in power to bichloride of mercury, free from noxious properties, and capable of penetrating the tissues of the body and destroying pathogenic micro-organisms embedded therein. The new drug was immediately put to use in all branches of surgery, and before long very contradictory reports of its action appeared. Such acute observers in ophthalmic and aural work as Cheatham, Gould, and Galezowski were warm in its praise, while others found no benefit from its use, and some even condemned it as harmful. The same was true of the reports of its use in general surgery, in cases of malignant tumours, as well as in general medicine, and the drug was thus shown to be unreliable. The cause of this unreliability was explained by Liebreich in 1890, when he demonstrated that the composition of pyoctanine was uncertain.

The presence of pathogenic micro-organisms may be said to be the one general indication for this drug, but excellent results have been obtained in diseases not supposed or not known to be dependent upon such a cause. Thus the number of pathological conditions in which much improvement has been noted includes almost all of those accompanied by a purulent discharge. In *suppurating wounds* and *chronic ulcers*, in *conjunctivitis* and *dacryocystitis*, in *furuncles* and *otorrhœa*, in *gonorrhœa* and *cystitis*, its use has been highly extolled. Good results have also been obtained in *herpetic ulcers of the cornea*, in *trachoma*, the dependence of which upon a micro-organism is probable, but not yet definitely determined, and in clearing up certain *corneal opacities*.

A case of *idiopathic ptyalism* which had resisted other treatment has been reported by Heiman as promptly cured by the local application twice daily to the mucous membrane of the mouth of a 0·1-per-cent. solution.

The injection of pyoctanine into the substance of *malignant neoplasms* has been attended with the same contradictory results which have already been noted. In several cases malignant growths have been alleged to have been cured, and in other cases marked retrogression obtained.

Höring found that in *diphtheria* a 3-per-cent. solution, applied two or three times a day, destroyed the false membrane and diminished pain and fever without giving rise to

toxic symptoms, but, unfortunately, such good results can not always be thus obtained.

In *phthisis pulmonalis* injections of a solution have been made into cavities in the lungs with benefit. The temperature has been reduced and the bacilli have disappeared from the sputum. The danger in this treatment lies in the injurious effect upon the kidney.

Pyoctanine has been given internally in doses of from ½ to 3½ grains, three, four, or five times a day, in *malarial fever, gonorrhœa, acute* and *chronic nephritis, pleurisy, adenitis, endometritis, typhoid fever,* and *malignant neoplasms.* The cases of malarial disease in which this drug seems to be indicated are those which have resisted other treatment. According to Thayer, in the majority of such cases which he treated in this manner the plasmodia disappeared from the blood after a few days, and but rarely could be found after three weeks. It is quite possible that this valuable antiplasmodiac power is due, not to the pyoctanine itself, but to the arsenic which is frequently present. When given alone, pyoctanine is apt to produce strangury, but this can be prevented by combining it with nutmeg. In *acute nephritis* it is said to have quadrupled the amount of urine, and to have caused the disappearance of casts and of the cardiac and pulmonary symptoms together with the accompanying œdema. Its use in a few cases of *leucocythæmia* has resulted in a diminution of the number of leucocytes, but in some of the cases the number of the red blood-corpuscles has seemed also to have been diminished.

It is commonly used in solutions, which vary in strength from 1 to 2,000 to 1 to 100. It should be borne in mind that these solutions are unstable, and Stilling's directions should be carefully followed. A solution, when made, should be filtered, kept in dark glass bottles, and renewed every eight days. Possibly some of the failures which have occurred have been due to neglect of one or more of these precautions. The pure drug may be used as a powder, but usually when it is desired to use it in this way it is best to dilute it with some inert substance like tale, to a strength of from ½ to 2 per cent. The paste may be moulded into pencils, either large or small, which may be applied directly to the diseased tissue. Ointments from 2 to 10 per cent. in strength are useful in some cases.

A strong objection to the use of pyoctanine is that it will stain the skin or any clothing with which it comes in contact a deep purple colour. This stain may, however, be removed by means of dilute hydrochloric or nitric acid, alcohol, or cologne water.

MATTHIAS LANCKTON FOSTER.

PYRANTINE.—According to the *Chemische Zeitung* (cited in the *Pharm. Rev.*, March, 1895), this substance, first prepared by Piutti, is a succinic-acid derivative of phenacetine, a colourless crystalline body of the formula $CH_2{-}CO \\ | \\ CH_2{-}CO \rangle N{-}C_6H_4{-}OC_2H_5$. It is said to have been used in several of the Italian university clinics as an *antipyretic* and in the treatment of *acute rheumatism*, in daily amounts of from 15 to 45 grains. The usual statement is made that no bad effects have been noticed from its use, but prudence seems to dictate that we should refrain from employing it in practice until we have further information concerning its action.

PYRAZINE, PYRAZOL, PYRAZOLINE, PYRAZOLONE.—These derivatives of pyrrol have had various formulas assigned to them. According to A. H. Allen (*Pharm. Jour. and Trans.*, 1890; *Am. Jour. of Pharm.*, 1892), they are as follows:

Pyrazine, $HN\begin{cases}.NH.CH_2.\\.CH_2.CH_2.\end{cases}$.

Pyrazol, $HN\begin{cases}.N:CH.\\.CH:CH.\end{cases}$.

Pyrazoline, $HN\begin{cases}.N:CH.\\.CH_2.CH_2\end{cases}$.

Pyrazolone, $HN\begin{cases}.N:CH.\\.CO.CH_2.\end{cases}$.

These substances have been proposed as *antipyretics*, but Dr. Cerna says of pyrazol that it lacks antipyretic properties, but has been used as a *diuretic*. He gives the dose as from 15 to 30 grains. It is doubtful if any of these compounds will take a lasting place among remedies; certainly they can not now be said to have got beyond the experimental stage.

PYRETHRUM (U. S. Ph.), *pyrethri radix* (Br. Ph.), or pellitory, is the root of *Anacyclus Pyrethrum*. It is of little importance from a medical standpoint. When chewed, it acts as a *sialagogue* and stimulant of the mucous membrane of the mouth, and has been employed in *headache, toothache, paralysis of the tongue*, and *relaxation of the soft palate*. From 20 to 60 grains may be used. In the shape of a tincture, *tinctura pyrethri* (U. S. Ph., Br. Ph.), it is employed by dentists to relieve toothache and to add a local stimulating effect to tooth washes.

The flowers of *Pyrethrum Parthenium* are often substituted for chamomile flowers, and apparently with as good results.

Pyrethrum carneum and *Pyrethrum roseum* furnish the Persian or Caucasian insect powder of commerce, and *Pyrethrum cinerariæfolium*, the Dalmatian variety, which is rather more active than the others. It occurs as a yellow or yellowish-brown powder, and is the most valuable *insecticide* known, as it is without any poisonous effects upon man or the higher animals, at least in the quantities commonly employed. It is not very rapid in its action, first stupefying or intoxicating the insects which come in contact with it, but death ordinarily follows in a short time. Upon the eggs it appears to have but little effect, and on that account is less efficient than mercurials for the destruction of bedbugs and roaches. Upon ants it seems to have rather less effect than upon the other insect pests of the household. It is of importance that it should be as widely disseminated as possible, and for this purpose a bellows is a very convenient appliance. One specially adapted for the purpose may be found nearly everywhere. In beds infested with bugs

the powder may be scattered over the bedding as a temporary measure, and rarely causes any inconvenience beyond in some instances a slight and temporary irritation of the skin. A small quantity sprinkled on hot coals will clear a room of flies or mosquitoes, and it is probable that for several hours the entrance of others will be prevented. Pastils are made, containing small quantities of nitre, which may be employed in the same manner. In kitchens and other places where flies are abundant it may be scattered around at night, the apartment being tightly closed until morning, with the result of killing all there are present. A solution of from 20 to 30 grains in half a gallon of water is very suitable for spraying upon plants infested with insects, but its expense renders its range of usefulness rather limited. A 20-per-cent. alcoholic tincture, diluted as desired and applied to the body, is very effectual in keeping fleas, etc., from remaining upon the person. Dogs, cats, and other animals infested with fleas may be relieved of them by a thorough dusting, but it is wise to select some spot remote from the dwelling to do this in, and if possible a sandy spot upon which the sun shines brightly is the best, as the dry heat insures the death of the insects; as a matter of fact they are unable to endure exposure to the naked rays of the sun. Fowls may be treated in the same manner, being held head downward in a barrel and the powder sifted among their feathers. Poultry houses, pigeon lofts, etc., may be freed of vermin by its liberal and frequent employment. It is hardly necessary to specify every purpose to which it may be applied, but in addition to the foregoing it may be employed in cabinets for furs and woollen fabrics, and in almost every place where insects destructive to such objects are found. The recently introduced buffalo bug, which is so destructive to carpets and rugs, appears to be but little affected by it. Carbon bisulphide, naphtha, and similar petroleum products are almost the only agent effective for their destruction. It is of great importance that insect powder should be fresh, as it loses its virtues on keeping. Much of it is inert and worthless.—Russell H. Nevins.

PYRETINE, an American proprietary *antipyretic* and *analgetic*, is said to be a mixture of acetanilide, caffeine, calcium carbonate, and sodium bicarbonate. It has not come into general use.

PYRIDINE is a basic substance obtained from bone oil, coal tar, naphtha, and other organic materials by distillation. It also occurs in tobacco smoke, a fact which has led some observers to credit it with the remedial action tobacco smoking has in asthma. When pure, it is a colourless, volatile liquid with a powerful and persistent empyreumatic odour and a pungent taste. It is freely miscible with water, alcohol, ether, chloroform, and fatty oils. Its formula is C_5H_5N. With acids pyridine forms crystallizable but unstable salts.

Although the physiological action of pyridine has not been exhaustively studied, it would seem that it is an agent of most vigorous action. Locally applied, it is *antiseptic*. Given in small doses, according to De Renzi, it stimulates cardiac action and raises the blood-pressure. This action on the blood-pressure, however, is denied, and many maintain that the blood-pressure is lessened by it. Inhaled, it diminishes bronchial spasm when that is present, and experiments upon animals show that it quiets irritability of the respiratory centre. In large doses, however, the drug is actively poisonous, causing cyanosis and muscular feebleness and paralysis from action upon the motor centres and nerves. Death may result from respiratory paralysis.

The chief therapeutical employment of pyridine is in the relief of *bronchial asthma*. The treatment was introduced by Germain Sée. A drachm of the drug is exposed in a saucer in a small room, the patient remaining in the room and inhaling the pyridine-charged atmosphere for a period of from fifteen to thirty minutes several times a day. Although the treatment is exceedingly disagreeable, because of the offensive odour of the drug, it is said that much relief follows its use, the respirations becoming free and the disease often subsiding after a number of exposures to the treatment have been endured. Instead of inhaling pyridine thus, a solution containing from 5 to 20 drops in 2 oz. of water may be respired by atomization, or a few drops may be directly inhaled. *Angina pectoris* is said to be benefited by the internal use of pyridine, from 5 to 10 minims being taken daily and the dose gradually increased until 25 minims are taken in a day. In *cardiac enfeeblement* it is said to exercise a beneficial effect, and has even been thought a substitute for digitalis. The antiseptic action of pyridine may be made use of in the treatment of *gonorrhœa*, an injection of a watery solution (1 to 300, or even stronger) being employed.

Henry A. Griffin.

PYROACETIC ETHER or **SPIRIT.**—See Acetone.

PYRODINE.—See Hydracetin.

PYROGALLIC ACID, PYROGALLOL (U. S. Ph.), **PYROGALLOLUM** (Ger. Ph.), is a trihydroxylbenzol with the formula $C_6H_6O_3$. When gallic acid is heated to sublimation it is decomposed and carbonic acid and pyrogallol are formed. The latter substance occurs in long, flattened, prismatic or needle-like crystals, very light in weight, of a pearly colour, bitter to the taste, soluble in from 2½ to 3 parts of water and also in alcohol and in ether. It fuses at 239° F. and boils at 410° F. It is a strong reducing agent. A watery solution of it, with soda or potash, as well as the moistened crystals themselves, becomes soon of a reddish or dark-brown colour from oxidation, and it readily reduces the salts of mercury, silver, gold, and platinum. Pyrogallic acid is largely used in connection with nitrate of silver in photography, and also in the compositions of hair dyes and marking inks. To its property as a reducing agent are chiefly ascribed also its therapeutic effects. Pyrogallic acid had seldom, if ever, been employed

in medicine prior to 1878, when Jarisch first introduced it as a remedy for certain cutaneous diseases. The diseases for which he especially recommended it were *psoriasis* and *lupus*, but it has also been found of more or less value in parasitic diseases, such as *eczema marginatum*, in *epithelioma*, and in *simple chancre* or *phagedæna*.

In *psoriasis* it is generally admitted to be of considerable value when applied locally. It acts with less energy upon the disease than chrysarobin, which in many respects it resembles, but is more energetic in its action than tarry preparations. It is odourless and but slightly irritating to the skin (rarely causing the dermatitis that so often follows applications of chrysarobin). It is often preferable to chrysarobin where the skin does not tolerate the latter, as upon the face, or in individuals with unusually vulnerable or sensitive skins. It does, however, cause irritation at times, producing considerable pruritus and occasionally follicular papules or pustules, which may require a temporary suspension of its use. It stains the skin and clothing only slightly less than chrysarobin. A more serious objection to its use when incautiously employed, so as to permit considerable absorption, lies in the fact that it may give rise to grave toxic effects. Attention was first called to this danger by Neisser, who reported a case of fatal intoxication following inunctions of one half the body with a 10-per-cent. ointment, the surface having afterward been covered by gutta-percha tissue and a bandage. The symptoms began in two hours after, with rigors, diarrhœa, vomiting, and strangury. The next day the urine was very dark-coloured from the presence of hæmoglobin; all the symptoms became aggravated, with apathy, dyspnœa, exaggerated reflexes and collapse, followed by death two days later. The cause of death was stated to be decomposition of the blood with hæmoglobinuria and nephritis hæmoglobinurica. Though pyrogallic acid is a more dangerous remedy than chrysarobin to the general economy, when applied to limited areas there is probably little to fear from it. It would be especially objectionable in a case of psoriasis attended with much excoriation or eczema, or in that form which approaches the character of an exfoliative dermatitis. The mode of its employment in psoriasis is similar to that of chrysarobin. A 10- to 15-per-cent. ointment is thoroughly rubbed into the affected areas. The ointment is preferable to preparations with traumaticin or gelatin, as well as to plasters. On the first indication of gastro-intestinal disturbance, strangury, or smoky urine, the remedy should be at once discontinued. In case of decided toxic symptoms Neisser recommends subcutaneous injections of ether, alcoholics frequently repeated, energetic stimulation of the surface, and the inhalation of oxygen.

In *lupus* pyrogallic acid has proved itself a remedy of no little value. It is especially suited to the more superficial forms. It acts on continued application as a mild *escharotic*, and, while it has but little effect upon the epidermis, it has a selective action upon the diseased subepidermal tissue, in this respect resembling the action of the arsenical pastes. The rapidity of its action is increased when the epidermis is intact by first applying a moderately strong solution of caustic potash. An ointment of the strength of from 10 to 20 per cent. is applied on lint and covered with a piece of gutta-percha tissue, which may be made to adhere to the surrounding skin by moistening its edges with chloroform. The applications are renewed daily and continued for from two to seven days or until the lupus patch has become converted into a gray pultaceous mass, when the pyrogallic acid is replaced by an ointment of iodoform or the emplastrum hydrargyri. This treatment is repeated at intervals so long as any lupus tubercles are apparent. The scars left are smooth and supple. Besnier uses a saturated solution of pyrogallic acid in ether, which is brushed over the lupus patch and covered in with traumaticin, repeating the applications as above described. Brocq prefers a solution of pyrogallic acid with salicylic acid (10 per cent. of each) in collodion.

Epithelioma of the skin has been treated successfully with pyrogallic acid employed according to the same methods as those recommended for lupus.

In *chancrous ulcerations* Vidal has found this remedy efficacious. For simple chancre he used a salve consisting of 1 part of pyrogallic acid in 4 parts of lard or vaseline, and for *phagedæna* a powder composed of pyrogallic acid and starch in the proportion of one to four.—Edward Bennet Bronson.

PYROGLYCERIN.—See Nitroglycerin.

PYROLIGNEOUS ACID.—This is an impure acetic acid, obtained by the destructive distillation of wood. It is the source of the acetic acid of commerce and of the pure acetic acid of the pharmacopœias. Crude pyroligneous acid, *acetum pyrolignosum crudum* (Ger. Ph.), and the rectified acid, *acetum pyrolignosum rectificatum* (Ger. Ph)., are used topically for the same purposes as acetic acid(*q. v.*).

PYROXYLIN (Br. Ph.), *pyroxylinum* (U. S. Ph.), or gun cotton, is official only because it is used in the preparation of collodion.

PYROZONE.—This name was at first applied by an American firm of manufacturing pharmacists, Messrs. McKesson and Robbins, of New York, to a thick syrupy liquid consisting of pure hydrogen dioxide, from the fact that when a fluffy fabric of silk or the like was saturated with the liquid and warmed slightly it took fire and burned "furiously, as substances do in oxygen, presumably producing both fire and ozone" (Coblentz).

Pure pyrozone speedily undergoes decomposition; hence it is furnished in solutions of certain standard strengths. The *3-per-cent. solution in water* corresponds in strength to the *aqua hydrogenii dioxidi* of the U. S. Ph., and is said to be purer and more stable than that preparation; also to admit of concentration by evaporation without appreciable loss of hydrogen dioxide. The use of this solution is

the same as that of hydrogen dioxide (see vol. i, page 503).

The *5-per-cent. solution in ether* and the *25-per-cent. solution in ether* have been found to be exceedingly efficient *stimulating* and *caustic* applications, particularly valuable in checking *suppuration*, notably that of *pyorrhœa alveolaris*.

QUASSIA (U. S. Ph.), *quassiæ lignum* (Br. Ph.), *lignum quassiæ* (Ger. Ph.), is the wood of *Picæna* (*Quassia*) *excelsa*, a tropical and semi-tropical tree. It is a simple *bitter tonic* which appears to have no injurious effects upon the economy unless it is taken in enormous doses, when it acts as an irritant of the mucous membrane of the stomach and as a nauseant. It is a very useful bitter in all cases of *lack of appetite* and *atony of the stomach*, and is particularly applicable in malarial affections in which a stomachic is desirable. Its action depends upon a principle, *quassiin*, or *quassin*, which may be substituted for the drug or its preparations in doses of ½ a grain. The wood readily imparts its properties to cold water, and cups are made of it in which water is allowed to stand for two or three hours, or until it becomes distinctly bitter, and then drank. This method of administering it used to be quite common and is a very useful one, as the cups retain their properties for a long time and are always ready for use. The extract, *extractum quassiæ* (U. S. Ph., Br. Ph.), may be given in doses of from 1 to 2 grains. It is perhaps to be preferred to the other preparations because, bulk for bulk, it contains a larger amount of the bitter-tonic principle than any of them. The fluid extract, *extractum quassiæ fluidum* (U. S. Ph.), is also a powerful preparation; it is used in 5- to 10-drop doses. The infusion, *infusum quassiæ* (Br. Ph.), possesses all the properties of the drug, but is somewhat objectionable on account of the bulk of the dose, from 1 to 2 fl. oz. The tincture, *tinctura quassiæ* (U. S. Ph., Br. Ph.), is used oftener as an ingredient of tonic mixtures than by itself; it may be given in doses of from 1 to 2 fl. drachms.

An infusion of 2 oz. of quassia in a pint of boiling water, when of the proper temperature, is used as an enema for causing the expulsion of *ascarides*, and is very efficient. The same effect is said to be produced when quassia is administered by the mouth, but the enema is much surer. By macerating 10 parts of the wood in 50 of water for twenty-four hours and adding enough sugar or molasses to make the strained infusion somewhat syrupy, a mixture is formed which is very effectual as a *fly-poison*. It may be exposed on a plate, or on cloth or paper soaked in it and hung up. It is perfectly harmless.—Russell H. Nevins.

QUEBRACHO, *aspidosperma* (U. S. Ph.), is the bark of *Aspidosperma Quebracho*, or *quebracho blanco*, so named from the light colour of its wood. The bark employed is collected from old trees after the corky layer is well developed. The first detailed description of the drug came from Penzoldt, who asserted that by its use some forms of *dyspnœa* depending upon disturbances of the circulatory or respiratory apparatus could be diminished or entirely removed. He maintained that no deleterious effects were produced on other organs by its administration. Although the drug has a disagreeable taste, and occasionally causes nausea or diaphoresis, or salivation after its ingestion, there seemed to him to be no lowering of the pulse-rate accompanying the diminished respiratory frequency (*Die Wirkungen Quebrachodrogin*, Erlangen, 1881). Penzoldt believes that quebracho acts by increasing the power of the hæmoglobin to take up oxygen, but he found that when it was given in an overdose the oxygen was retained in the blood and metabolism was diminished.

Five alkaloids have been derived from quebracho: *aspidospermatine*, which is believed to hold the active principles of all the other alkaloids; *aspidosamine*, *quebrachine*, *hypoquebrachine* and *quebrachamine*. Of these, quebrachine is the one most frequently employed. *Aspidospermine*, an impure mixture of the alkaloids, is sold in the market as a fluid extract and as a solid extract. The dose of the former is from ½ to ½ a fl. drachm; that of the latter, from 1 to 3 grains. Penzoldt recommends quebracho in *asthma* accompanied by *emphysema*, even in the presence of pleurisy or bronchitis. He praises it, also, in *bronchial asthma* and in all cases of *dyspnœa arising from cardiac disturbances*, in which compensation is well established. In dyspnœa, however, due simply to a weakly-acting, diseased heart, it is not recommended, since it lacks the influence of digitalis upon the ventricles. Flint gave quebracho cordial praise in all cases of dyspnœa, particularly when this symptom was caused by *mitral insufficiency*. In the absence of other organic disease, he used quebracho for the symptom dyspnœa (*Med. News and Abstract*, May, 1881, p. 273). The drug has been employed, also, for the relief of *uræmic dyspnœa*, but it is to be doubted if it is as valuable in this emergency as other remedies; as a *stomachic tonic*, it formerly enjoyed some repute. After prolonged use, quebracho seems to cause some disturbance of the sympathetic nervous system.

Like many other drugs, quebracho has been recommended for the protection and stimulation of wounds; it has been superseded, of course, by other substances.

The dose of the fluid extract, *extractum aspidospermatis fluidum* (U. S. Ph.), is from 15 minims to 1 fl. drachm. The non official preparations of quebracho are a tincture and a wine. The dose of the former is from 10 to 20 drops; that of the latter, from ½ to 1 fl. drachm.

Quebrachine, one of the most active of the alkaloids of quebracho, has been used instead of the original drug. It appears in the market as the hydrochloride and the sulphate, of which the dose is from 1 to 3 grains.

Samuel M. Brickner.

'earth-gall.' Supreme virtues exist in it when used in liver, spleen, and joint diseases, jaundice, and dropsy; for which purposes a powder [made from it] is mixed with anise-seeds and drunk in beer and wine. It induces the menstrual flow and restores a lost appetite. It rids the body admirably of pin-worms, if an infusion of it is spread on a cloth over the abdomen . . . . It is valuable above all in the treatment of tertian and quartan fever." Though old Helmont, the compiler, placed the most important indication of the drug last in his category, one can see that the indications which call for quinine have not varied much in the last two hundred years. The alkaloid and its salts are used to-day for many phases of disease for which there is no more primary indication than in the ancient medical tale of our fathers. Rheumatism and typhoid fever were formerly the diseases cured specifically by quinine; and there are still many physicians who regard it as more than valuable in these ailments. Its efficacy in intermittent fevers is classical, however, and even fiction has helped to establish its permanency, as in *Twenty Thousand Leagues under the Sea.*

In their physiological action, the alkaloid and its salts are so nearly identical that they will be considered together, only such peculiarities of each as recommend it for particular uses being specified. An enumeration of the officinal salts follows: *Quinina* (U. S. Ph.), *quinine* (Br. Ph.), is the alkaloid proper. Its recognised salts are: *quininæ bisulphas* (U. S. Ph.), *acid quinine sulphate* (Br. Ph.), *quininæ hydrobromas* (U. S. Ph.), *quininæ hydrochloras* (U. S. Ph., Br. Ph.), *chininum hydrochloricum* (Ger. Ph.), *quininæ sulphas* (U. S. Ph., Br. Ph.), *chininum sulfuricum* (Ger. Ph.), *quininæ valerianas* (U. S. Ph.), and *chininum tannicum* (Ger. Ph.). In the U. S. Ph. there is also an officinal double salt, the citrate of iron and quinine, *ferri et quininæ citras* (U. S. Ph., Br. Ph.), *chininum ferro-citricum* (Ger. Ph.), which contains 12 per cent. of quinine. Among other numerous salts of the alkaloid that have been praised for some virtue or other are the arsenite, the hydrochloride with urea, the lactate, and the acetate. The bichloride of quinine is another salt but recently added to the long list of those that have been compounded for some special purpose.

In general, it may be stated that the effects of quinine, as manifested upon the body and its organs, depend upon the dose. Whereas small doses are stimulating and tonic in their influence, large doses administered to the same individual are sedative and depressing. Particularly is this true of the circulatory and nervous systems, which respond well and quickly to the action of the drug. The various peculiar manifestations observed in the organs of special sense, in the cerebrum, in the skin, and in the internal organs may be summed up in the universal harbour of medical refuge—personal idiosyncrasy. Yet, though it is unquestionable that some individuals are more susceptible to the subtleties of this than to those of other alkaloids, it should never be forgotten by the physician that quinine is not an indifferent drug which can be administered regardless of dose and of the personal element. While it would be perfectly safe, for example, to administer from 6 to 10 grains of quinine to an otherwise healthy woman who was at the same time pregnant and suffering from malarial disease, it would probably induce an abortion or miscarriage in a woman with intermittent fever whose general condition was deteriorated by excessive work and worry. Again, a man who required a stimulant tonic might do very well on a pill or a mixture containing quinine, or he might show such decided personal susceptibility to the drug that its withdrawal would be imperative. The personal element, then, is as important in the administration of the cinchona alkaloid and its salts as it is in that of any other drug which produces pronounced effects. In respect to the differences manifested by different alkaloids of cinchona, cinchonine seems no less inert than quinine, but its action is not so prolonged or so intense.

The symptoms of the condition known as *cinchonism* appear after the use of either, but in the case of cinchonine the familiar buzzing in the ears is not so early a phenomenon, but an intense frontal dulness accompanied by præcordial distress, subsultus tendinum, and faintness with other severe nervous manifestations, appear. Indeed, it would seem that it requires a smaller dose of cinchonine to produce a physiological effect than of quinine.

The causation of cinchonism has been a puzzle to physiologists. Of its existence, however, there is daily proof. There are few individuals who have taken quinine in moderate doses for any length of time who have not experienced some of the phenomena which mark its presence. Therapeutic doses of quinine (5 to 10 grains) produce the first symptoms. These are, usually, a buzzing or ringing, a feeling of fulness or heaviness or both in the head, and there may be partial deafness. If the drug is withdrawn, these symptoms disappear spontaneously. Should its use be continued or larger doses given, there is an exaggeration of the symptoms mentioned, with those of cerebral congestion. The deafness becomes almost complete, if not absolutely so; an amaurosis is developed which may well be called toxic; the face is flushed, and there are decided giddiness and an intense feeling of distention in the head. An ataxic gait may accompany the other functional disturbances. After the administration of more than a physiological dose, pronounced symptoms of poisoning show themselves in rapid succession. At first there is a heaviness in the head, with tinnitus aurium; then there are confused and disturbed trains of thought, followed often by delirium. If the dose has been sufficiently large, loss of consciousness, complete deafness, and blindness ensue. The sensibility of the skin disappears, and the limbs are powerless. Intense paresis, sometimes paralysis, follows. The respiratory movements are not free, and death may take place in coma or in delirium, usually with symptoms of asphyxia. The treatment of such poisoning is direct and indirect. If the patient is seen sufficiently early, gastric

would seem likely that those who favour the view of leucocytosis are correct. Upon the red cells it is probable that the effect is to diminish their number to a slight degree, though the form of the red cells, according to the greater number of observers, remains unchanged. That the quinine solution, through its ability to modify or even destroy protoplasmic structure, profoundly influences the contents of the blood-cells, is not in doubt. By the use of the drug the coagulability of the blood is diminished, and diapedesis and emigration—a "paralysis of the leucocytes"—are embarrassed. An effect upon the hæmoglobin seems to be a diminution in its oxygen-carrying properties.

The fall in blood-pressure after the administration of quinine is due, unquestionably, to two causes: 1. To a dilatation of the peripheral capillaries and smaller arteries. 2. To a diminution in the force of the heart-beat. The former effect may be a local one, but it is more probably due to a slight paresis of the vaso-inhibitory centre. The action upon the heart is caused by the influence of the drug upon the heart muscle or its resident ganglia. The pulse, naturally, shows variations which correspond to the degree of these changes, which, in the use of therapeutic doses, are gradually brought about. Poisonous doses succeed in paralyzing the heart muscle after having first rendered its beat very rapid with much diminished force. Small, tonic doses of quinine act as a stimulant to the circulatory as to the nervous system.

After its absorption into the blood and when it is not excreted in the fæces, quinine is eliminated principally through the kidneys. It can be found in the urine shortly after its introduction into the system, though it takes some hours for the total quantity to be excreted. A peculiar effect on the urine is the decrease in nitrogenous elements excreted. Experimental evidence leads to the belief that it is not due to diminished excretion, but to a lessening of metabolic changes in the body, involving the destruction of proteid elements. During its passage through the genito-urinary tract, quinine may cause renal or vesical irritation with albuminuria, hæmoglobinuria, or cystitis. Increased frequency of micturition and retention of urine have been observed; and occasionally erotic excitement has been manifested. Large doses of quinine, however, may allay vesical irritation or tenesmus.

The primary effect of moderate doses upon the respiration is stimulant. The rate of breathing is increased, but the respiratory movements are not materially deepened. Toxic doses call forth dyspnœa with stertorous, embarrassed breathing. Death may ensue from asphyxia, as described above. This is undoubtedly due to central action.

The reduction in the size of the spleen subsequent to the administration of quinine in malarial disease is due to the elimination of the disease. But experimental observers have recorded the fact that the spleen in lower animals has shrunk in size and its capsule has become loosened and its parenchyma tougher after the administration of quinine. Be this as it may, it is probably true that the diminished spleen, not only in malarial disease, but also in other infective processes, is due to the victory over the disease rather than to any specific action on the organ.

A variety of opinions have been expressed as to the influence of quinine upon the gravid uterus. The statements that follow are, however, the best teaching of the profession at the present time. An otherwise healthy pregnant woman suffering from malarial disease may take quinine with safety to her offspring. A debilitated, overwrought, highly nervous pregnant woman under the influence of malarial poison may miscarry whether she is given quinine or not; but in precisely these cases in which malaria may induce abortion or miscarriage the judicious use of quinine may prevent the mishap. When *dystocia* arises from exhaustion of the mother, generous doses of quinine, by their stimulation to the uterine muscles, frequently are of service. Mental encouragement is of value, however, by inducing the patient to believe that the drug will have the action desired. Atkinson (*Am. Jour. of the Med. Sci.*, February, 1890) concludes that quinine occasionally has an *oxytocic* action if there is an idiosyncrasy, and he advocates its use in *prolonged labours* with exhaustion of the mother or threatened *uterine inertia*. In this position he is indorsed by the bulk of the profession.

The local action of quinine demands some consideration. Applied to the skin denuded of its epidermis, quinine and its salts, in powder or in solution, are active irritants. Upon an intact skin little or no irritating influence is perceived, but upon mucous membranes a distinct irritating and stimulant effect is observed. This is particularly marked in some individuals who can not take the drug by the mouth or by the rectum. The prolonged internal administration of quinine, or even, in isolated cases, a single dose, has called forth eruptions. These may assume any character, from a mere erythematous blush to papules and vesicles. Allen (*Med. Record*, January 26, 1895) has reported a case in which the eruption was like that of scarlet fever, becoming successively urticarial, œdematous, and bulbous, leaving an excoriated surface. After a quinine eruption there is frequently an exfoliation of the skin. These instances are undoubtedly to be accounted for by the marked idiosyncrasy manifested by some persons against the drug.

The *antiseptic* action of quinine has long been recognised. A solution of 1 part to 300 will preserve organic foods for a great length of time, and in a similar proportion quinine will check alcoholic fermentation in saccharine substances. Upon the higher and more virulent forms of bacteria its action is decidedly less powerful, although in the early antiseptic period it was used in a spray instead of carbolic acid. It is principally upon fungi that its antiseptic influence is strongest.

The *antipyretic* action of quinine has never been satisfactorily explained. Wood does not believe that it is due alone to the diminished oxygen-carrying function of the blood, but

rather to the drug's influence upon the specialized nervous tissues of the body—in other words, the heat centre. Upon a normal bodily temperature quinine exerts but a feeble, if any, antipyretic action. But in febrile conditions of any kind, or at least of most kinds, the thermometer shows a marked fall after its administration. Quinine is not a universal remedy for all febrile diseases, though its enormously wide clinical and therapeutical application would lead one to believe that it was a specific for almost all diseases in which there was an abnormal rise of temperature.

The first important therapeutic application of quinine is in the various forms of *malarial disease*. In this disease it is a specific. Although other antiperiodics have been tried, and although many other alkaloids have been vaunted as curing or aborting an attack, quinine stands forth pre-eminent in its ability to prevent, cure, or abort the various forms of malarial intoxication. Consideration must be extended in three directions in its application in malarial disease: 1. Its prophylactic use. 2. Its curative use. 3. Its specific action on the *Plasmodium malariæ*.

Laveran's work has received such almost unanimous recognition and acceptance that for the purposes of this article it will be assumed that his discovery of the malarial parasite is universally believed. The clinical evidence of the value of quinine in malarial affections is only strengthened by the adoption of the view of the plasmodium as the ætiological factor—and the sole one—in the causation of this group of diseases. In the classical report on The Malarial Fevers of Baltimore (*Johns Hopkins Hosp. Rep.*, 1895) it is stated, in the too brief chapter on the action of quinine, that the best time to attack the malarial organism is during the period of segmentation. In the tertian type of the disease this can be best accomplished by giving one moderate dose just before the expected paroxysm, so that the quinine salt shall be in solution in the blood at the time of division. Blood examinations made immediately after the paroxysm show that entire groups of the plasmodium disappear. It is found that in the intervening stages—in which the parasite is in the endoglobular stage—quinine, administered in a single dose, has little effect upon the further development of the organism. In mild tertian cases a moderate dose, given from ten to twelve hours before an expected paroxysm, may avert the chill, but it is more efficacious if given nearer the time of the expected attack. In tertian and quartan cases treated with quinine the plasmodium disappears from the blood within the first four days. In the quotidian type, if the patient is energetically cinchonized, it may disappear even sooner. It is not known in what manner quinine is antagonistic to the specific organism which produces malarial disease, but it is probably by some direct influence which destroys its vitality. Certain it is, that in addition to the clinical history of nearly three hundred years to substantiate the title of cinchona as a specific in intermittent fever, we have the direct evidence that quinine attacks the cause. We have every right, therefore, to regard quinine as a specific antiperiodic (and antipyretic, incidentally) in the various manifestations of malarial disease.

Two recognised plans are followed in the treatment of *intermittent fever* with quinine. The first is the daily administration of a dose sufficiently large to control the paroxysms. The second consists in giving the drug immediately after a paroxysm, on the supposition that the *Plasmodium malariæ* yields most easily at that time. Either plan may be followed, and both will give good results. But one thing is essential: the patient under treatment must receive his physiological dose of quinine—he must be cinchonized. By the former plan the patient will receive daily from 15 to 30 grains of quinine, given in divided doses; less than 4 grains in one dose it is useless to give to an adult, since that quantity produces no appreciable effect. In the so-called *pernicious* cases it is necessary, or it may become necessary, to increase the amount of quinine, for, to cure these cases, the patient must be fully under the influence of the drug, not only during the paroxysms, but during the intervals of the disease as well. When the symptoms are becoming less marked, the dose may be gradually diminished; but the drug should not be wholly withdrawn until some weeks have elapsed. The second plan involves the giving of from 15 to 25 grains of quinine, as the temperature falls in the first paroxysm observed. This is said to be sufficient to avert the second attack; but if slight symptoms should show themselves, the administration of a second dose of 10 or 15 grains is usually sufficient to control the disease. No further dose need be given until the seventh day, when from 15 to 25 grains are again given. Usually this suffices; but if a tendency to relapse is noticed, or if some of the milder symptoms of malarial infection present themselves, full doses of quinine must again be resorted to.

Sometimes a paroxysm seems to be best averted by giving quinine prior to a paroxysm, and, although some prefer giving divided doses, it seems more rational to give one or two large doses, for it would appear that small doses are able only to retard the development of the *Plasmodium malariæ*, while larger ones are able to destroy the micro-organism. Four hours is the shortest time in which a moderate dose (10 grains) of quinine can enter the blood in solution; hence the best time for giving the drug previous to an attack is from five to six hours. A dose of 15 grains will maintain its action in the body for from four to five hours, while a dose of from 5 to 8 grains will exercise its influence for from two to three hours. Doses in other amounts act for lengths of time corresponding to their quantity. As pointed out above, it is necessary for a patient to be cinchonized for the drug to be of the greatest value in overcoming the malarial infection. Otherwise the disease may linger and be protracted over many months, or relapses may occur. Free purgation is essential during the administration of a quinine salt. This may be accomplished by mercurials, by vegetable ca-

thartics, or, in the case of the pernicious forms, by diuretics.

The so-called "*hæmorrhagic*" *form of malarial fever* demands cinchonism at once. For this purpose, the administration of the alkaloid is much the same as in the ordinary intermittent type of the disease. From 15 to 20 grains may be given in one or in divided doses. For the condition known as *malarial cachexia* quinine is valuable; but after a long period of its administration, if a cure or relief does not follow, other drugs, such as arsenic, may be employed. The cachexia is dependent, indeed, not only upon malarial infection, but also on some tissue changes, and it is probable that not all cases can be cured. But even in this symptom-complex, quinine, in doses of 5 or 6 grains daily, has well-marked curative effects more frequently than not.

To refer briefly again to the pernicious variety of malarial infection, it is usually not sufficient to administer quinine alone. The grave phenomena presenting themselves on the part of the nervous system, the intestines, the lungs, and the kidneys render symptomatic treatment necessary as well. If, indeed, the gastric symptoms are pronounced, resort must be had to the giving of quinine by the rectum or hypodermically. Like all other drugs, quinine given subcutaneously acts more promptly than when administered by the mouth or by the rectum; but in this form of malarial disease the choice must rest upon the conditions present.

In the treatment of *remittent fever* quinine is indicated. Its results are not always so gratifying as in intermittent fever, but it is frequently curative. Quinine has probably an antipyretic effect in remittent fever when given at its height, and there seems to be no theoretical objection to administering it at this time. Many observers prefer to give the drug, however, as soon as the remission appears, using drugs other than quinine with thermolytic action to reduce the fever, or resorting to the full bath. Quinine frequently, however, succeeds in lowering the temperature and then exerts its specific action upon the micro-organism of the disease. No symptoms which may arise during a remittent fever are contra-indications to the use of the cinchona alkaloid. Should a severe gastritis arise, the drug may be given in solution or suppository by the rectum or subcutaneously, as in the pernicious type of the disease. In remittent fever, from 20 to 50 grains may be given in twenty-four hours, in one or in divided doses. (For the selection of quinine salts for hypodermic administration, see page 121.)

There are some forms of what are called "*masked intermittent*" *fever* which seem to be benefited by quinine. These ailments manifest themselves by the periodical appearance of certain functional disturbances without accompanying chill or fever. *Intermittent neuralgia*, very frequently of the trigeminal type, though it may appear in any of the plexuses or their branches, yields readily to quinine in sufficient doses. Sometimes, though not usually, the attack is of long duration, and the drug must be given for a considerable period of time. At the time of the onset a dose of from 15 to 25 grains may be given, which will usually relieve the symptoms. After the abatement of the attack, 5 grains, thrice daily, may be administered for a few days. Other phenomena have been described as occurring periodically, and have been attributed to malarial poisoning; but although they have seemed to yield to quinine, according to their reporters, the cases have not had the appearance of having been accurately and acutely observed. They embrace such functional disturbances as intermittent hæmorrhages, œdema, convulsions, and paralysis, and should probably be classified under other groups of disease than the malarial. However, if any such symptoms arise after an attack of malarial disease of any type, and are intermittent in character, there can appear no valid objection to thorough dosing with quinine. There are other forms of *neuralgia* which, though intermittent, are not periodic in character, that yield gracefully to quinine given for a few times. They can not, however, be supposed to be due to malaria, for any effect the quinine may have is soon lost.

When a patient suffers from intermittent malarial fever, or any of its forms, or from remittent fever, or from any of the intermittent forms of disease which appear to be dependent upon the invasion of the specific parasite of the disease, he should be removed from the locality at once if it is known to be malarial. The mere administration of quinine, though curative in a single attack, will not prevent recurrence if re-infection is possible. Pernicious cases, indeed, follow frequently upon one or more mild attacks. Prophylaxis against the disease is possible, however, by the judicious use of quinine. The effect of the drug need not be carried to the extent of cinchonism for this purpose. From 3 to 5 or even 8 grains may be given twice daily. It does not always succeed in preventing acquisition of the disease, but even in dreaded malarial tropical countries it has succeeded in keeping the disease aloof. When, after prophylactic treatment, malarial poisoning does make its appearance, it is altogether likely that it is less severe than it would have been had not such treatment been instituted. The experience of the British army in India in preventing a spread of the disease among the soldiers may be taken as a good example of the value of the prophylactic use of quinine.

Quinine has been recommended at various times for all the acute infectious diseases. In *acute articular rheumatism* it was used two hundred years ago, and was thought to be specific. Probably this belief rested upon its antipyretic power. At the present day it is used by some clinicians, not as a specific, but as a tonic, in doses of from 1 to 2 grains thrice daily during the convalescent stage. In *typhus fever* it is still used at the present day, and is believed not so much to exert any specific action on the course of the disease as to give tone to the organism during the critical stage. The well-known Huxham's tincture is used in this connection. As a curative agent in typhus it is, of course, worthless; but, together with

other tonics and stimulants, it may help to tide the patient over his crisis.

In *typhoid fever* it is also no specific, of course, although it has had wide use as an antipyretic. Strümpell is doubtful if the quinine salts, by their mere reduction of temperature, have any favourable influence upon the course of the disease. That they do sometimes reduce the temperature 2° or 3° F. is unquestioned, and in cases in which the bath treatment is contra-indicated (see HYDRIATICS) quinine may be used as an adjuvant in the treatment of typhoid fever. It must not be forgotten, however, that by its irritant action on mucous membranes it may injure the intestine which is the seat of the disease, and make a perforation possible. For the purpose of reducing temperature it may be used in doses of from 15 to 25 grains, given at once. Of more value is it in small doses during convalescence as a tonic, both gastric and general. It may then be given either in pill or in substance. A very good formula for a tonic containing quinine is:

℞ Quinine sulphate..... 1 grain;
Dried sulphate of iron..... 1 "
Arsenious acid..... $\frac{1}{30}$ "

Mix and make one pill. One such pill to be taken thrice daily.

Or,

℞ Quinine sulphate..... 1 grain;
Dried sulphate of iron..... 2 grains;
Extract of nux vomica.... $\frac{1}{4}$ grain.

Mix and make one pill. One such pill to be taken, thrice daily, before meals.

These combinations may, of course, be modified in many ways; but the drugs, combined as in the two formulas given, have virtues as tonics of a high order.

Quinine has been lauded in the treatment of *puerperal fever*, *small-pox*, *scarlatina*, and *erysipelas*, as well as in that of *diphtheria*. It has been given in these affections in the belief that it exerted some specific action on the poison of each disease. This is absolutely without foundation of proof. So far as its antipyretic action goes, it may relieve the patient of some of the symptoms of pyrexia, if administered in sufficiently large doses; but aside from this and from its tonic action, common to it in all forms of disease, there is no proof that it has any action which should demand its use. Prophylaxis in the first mentioned is of more importance than treatment, and for the other diseases of the group there is much to be hoped for in recent observations and investigations. Even in *cholera* quinine has been advocated on the ground that the difficulty of absorption from the intestines in this disease favours the antiseptic action of the drug on the comma bacillus. It is well known, though, that the antiseptic action of the cinchona alkaloid is too weak to exert any such effect on a bacillus of such virulence. In doses of from 20 to 40 grains it may help to combat the high fever of cholera, and its supporting action may also be brought into play with a favourable result should recovery ensue.

For many years the quinine treatment of *pneumonia* was a recognised form of treatment in New York. It does reduce the temperature in pneumonia, with a coincident falling of the pulse. Its use is not to be commended, for its indiscriminate employment may be productive of cardiac depression and failure. Certainly in the doses recommended in former years, 20 to 40 grains in one dose, it would be feared by many practitioners for its untoward influence upon the heart. Here, as in most of the febrile diseases, its tonic influence is valuable when convalescence has been established. It has been maintained that, if given early in pneumonia, as in *follicular amygdalitis* and *inflammations of serous surfaces*, it will modify the course of the disease. Indeed, one observer has alleged that the pneumonic process is less severe, that the cerebral, respiratory, and circulatory phenomena are less grave, if quinine is given in large doses early in the disease. It may cause, if given in a large dose, anorexia, nausea, and vomiting, and even cardiac weakness—symptoms which should be avoided or guarded against in pneumonia, of all diseases.

In some of the diseases of the respiratory tract quinine has had extended use. Like so many other drugs, it has been recommended in the treatment of *pertussis*. In doses of from 5 to 10 grains twice a day (the doses for infants are, of course, correspondingly smaller) it is said to diminish the frequency and severity of the attacks. It should be given early in the disease, if at all. Laubinger (*Jahrb. f. Kinderheilkunde*, xxxix, 2, 3) urges the subcutaneous use of the dihydrochloride of quinine in cases in which the symptoms demand instant relief. In *asthma* good results have been alleged from the use of quinine in diminishing the spasmodic attacks. The same has been asserted for it in *laryngismus stridulus*. More efficacious methods of treatment, however, are at our command. The *hectic fever* of *phthisis* may be reduced by the use of quinine, and it may be used as a tonic in *chronic phthisis* when there are anorexia and general weakness. As a gentle stimulant in *chronic bronchitis*, quinine may form part of a mixture or pill. A very good formula for this use is:

℞ Extract of belladonna..... 1 grain;
Extract of opium..... 2 grains;
Extract of nux vomica..... 3 "
Powder of ipecac..... 4 "
Quinine hydrochloride, or sulphate..... 5 "

Mix and make 20 pills. One pill to be taken four times daily.

In *acute coryza* and *hay-fever*, spraying the nostrils with an aqueous solution of from $\frac{1}{4}$ to $\frac{1}{10}$ per cent. has been reported to have cured cases. Or the quinine may be in the form of a snuff in a mixture containing bismuth or salicylate of sodium. The internal administration of 5 grains, three times daily, is advised in connection with the spray. In *influenza* it is doubtful if quinine, locally or internally, is of great utility. In the *albuminuria of scarlatina*, quinine, combined with tincture of chloride of iron, is said to be efficacious; but,

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like many other recommendations of quinine, this assertion rests on very little evidence.

For other internal and functional diseases, quinine has been praised. In the treatment of *insolation*, Binz (*Berl. klin. Wochenschr.*, 1895, No. 29) recommends the hypodermic administration of the bichloride of quinine. He says that at least 3¼ grains should be injected at one time, and this dose may be repeated in one hour if necessary. He alleges good results. Quinine in doses of from 3 to 8 grains relieves many of the chronic cases of *headache* which are the *bête noire* of the physician. Taken at night in one dose, in black coffee, for five nights, it has accomplished a cure of *migraine* which lasted for five months. In cases of *leucæmia* quinine has been tried on account of its supposed effect in reducing the size of the spleen, but it has no curative effect on the disease. Mosler, quoted in Strümpell's *Textbook of Medicine*, reported good results from its use. The drug has been tried in *diabetes*, on theoretical grounds, but it is valueless as a curative agent.

In the treatment of a few of the parasitic skin diseases, quinine, in a 5-per-cent. ointment, has been found valuable. In some forms of *pityriasis* and *tinea* it has been found efficacious. Given in doses of from 5 to 10 grains previous to the passing of a sound into the male urethra, it will prevent the remarkable rise of temperature known as *urethral fever*. Moreover, after this temperature—sometimes reaching 106° F.—has made its appearance, quinine will quickly reduce it. The writer can not refrain from adding that he has always regarded this phenomenon as directly due to a surgically unclean instrument. In the treatment of *gonorrhœa*, *cystitis*, and *growths at the neck of the bladder*, injections of quinine, of a strength of from 2 to 3 grains to an ounce, are said to be curative and to relieve the tenesmus which frequently accompanies these conditions. There are, however, better means of combating these ailments. Rectal injections of a similar strength are of value in treating an *amœbic dysentery* whose seat is low in the intestinal canal.

On the nervous system quinine has decided effects, and has been used in various functional and organic nervous diseases. The pains of *locomotor ataxia* sometimes yield to the alkaloid of cinchona, though, of course, the analgetic effect is due entirely to the sedative influence of the drug upon the peripheral nerves. Charcot's classical recommendation of quinine in *Ménière's disease* deserves the place it holds, for cases of cure are certain, and in some instances permanent. For this purpose, from 8 to 15 grains are taken daily in divided doses for a month. As mentioned above, *malarial neuralgias* yield to quinine in large doses (15 to 25 grains) if taken at once. And in the so-called "idiopathic" cases of *neuralgia of the trigeminal type*, quinine, pushed to the point of cinchonism, brings frequent relief. *Sciatica* yields less often to the influence of quinine. As a tonic, quinine is indicated in *neurasthenia*, in the combination of the formula given above. The drug has been used in *stenocardia* to prevent a recurrence of the paroxysm, but its use is purely tentative. In the so-called *hydrops articulorum intermittens*, a rare trophic disturbance, quinine may be used for its antiperiodic effect.

As hinted at above, quinine is of use during labour when the mother has become exhausted and *uterine inertia* is threatened. (See also under Oxytocics, vol. ii, page 55). Initial abortifacient power does not reside in the drug. For the purpose of aiding uterine action, it may be given in doses of from 5 to 10 grains every hour or in a single dose of 15 or 20 grains. In cases of *hæmaturia*, even if not of malarial origin, quinine is often serviceable, particularly in those instances in which the attacks are paroxysmal. When inunctions of mercury are given in severe cases of *syphilis*, the simultaneous administration of from 15 to 30 grains of quinine daily will prevent stomatitis and will help to cure cases which do not seem to yield to inunctions alone. (Dymnicki, *Monatshft. f. prakt. Dermat.*, 1889, No. 39.)

Quinine has some reputation as a tonic and stimulating drug in *prolonged suppuration* in any part of the body. It may be given internally or applied locally as an irrigating fluid. Thus, in cases of *empyema* of long standing, in which there are discharging sinuses, it may be injected into the cavity in a strength of from 4 to 5 grains to an ounce. Internally, it should be administered in the usual tonic dose. For *pruritus ani* or *vulvæ*, a strong solution of quinine is recommended for topical application. Ophthalmic surgeons use quinine in *acute glaucoma* and *blennorrhagic ophthalmia* with variable results. In some cases of glaucoma the pain seems to be diminished by the use of the drug.

[Dr. George Reich-Hollender, of Seattle (*Arch. of Ophthal.*, xxiii, 1 and 2), used a quinine lotion experimentally in an obstinate case of *gonorrhœal ophthalmia*, and found that after the third day the discharge became innocuous, and within two weeks not a vestige of the inflammation remained. By making cultures he satisfied himself that the gonococcus of Neisser was destroyed by a solution of quinine. He considers that the best way to employ quinine is in a solution containing hydrochloric acid. He believes it to be a specific in the ravages of the gonococcus. He makes a solution of 8 parts of quinine, 3 of dilute hydrochloric acid, and 720 of distilled water, and applies it every hour.]

Knapp has recently used quinine in the *chorea* of children with good effect. It does not cure all cases, however. He does not consider the action of the drug to be due to its stimulation of the inhibitory motor functions of the spinal cord, but to some influence upon the toxines of the disease (*Boston Med. and Surg. Rep.*, February 28, 1895). Good results are also alleged for the use of the alkaloid in *nocturnal enuresis*, especially in nervous children in whom the inhibitory function seems to be disturbed. Four grains, three or four times daily, are given for this purpose.

Finally, quinine in solution may be applied to *unhealthy granulating wounds*, or to slowly-

healing *ulcers*. So many better topical applications are to be found, however, that it is scarcely worth while to discuss the use of quinine as a surgical aid.

The contra-indications to the use of quinine are inflammation of the middle ear—because of the congestion quinine produces in the middle ear and labyrinth—and acute inflammatory processes of the gastro-intestinal canal, for reasons already stated. Very rarely the influence of quinine upon the genito-urinary tract is irritating, so in acute processes in this region the use of quinine might be contra-indicated.

Each of the salts of quinine has uses to which it is particularly adapted. The sulphate and the bisulphate are used for similar purposes, for internal administration, and for *rectal* use. For hypodermic use the bisulphate, the hydrobromide, and the hydrochloride are preferred on account of their solubility in water. The bichloride and the hydrochloride with urea are also capable of use by subcutaneous injection. The administration of quinine varies with circumstances and with individuals. The intensely bitter taste of the alkaloid and its salts renders it necessary to disguise their taste. Quinine itself is rarely employed, the sulphate being the most commonly used of the salts. It must be mentioned that the sulphate frequently varies in its stability and in its effects. In two cases simultaneously observed by the writer, suspected malarial infection was treated with the sulphate of quinine. After several weeks of its administration with no improvement, the hydrochloride of quinine was given, and a cure resulted within a week. A point in the administration of quinine is the fact that children excrete quinine more rapidly than adults; but from the experiments of Oui it is no longer believed that suckling children suffer a cinchonic effect from the milk of their mothers.

Quinine may be administered by the mouth, by the rectum—in suppository or by enema—hypodermically, or dermically. The taste of quinine may be disguised by giving it in wafers, which is perhaps the most desirable method. It may be given in the form of pills, which may be coated to obscure the bitter taste. Mineral acids should follow the administration of the sulphate in order to facilitate the solution of the salt in the stomach. Either the sulphate or the bisulphate is better tolerated by the stomach if given in a solution of potassium tartrate. The albuminate of quinine is said to be acceptable to a sensitive stomach; but it is soluble in water only when hydrochloric acid has been added. If a rapid result is desired, a solution of the salt should be given, and to accomplish this most satisfactorily the bisulphate is usually employed. After its solution in water, aromatic sulphuric acid should be added, one drop for each grain of the drug. The tablets of the quinine salts in the market are not to be too cordially commended, for they are apt to defy solution. Tablets of tannate of quinine, in the form of chocolate lozenges, are sold in the shops, each tablet containing 1 grain of the drug. These are especially desirable for use among children, as the chocolate completely disguises the taste of the salt.

[A simple and very effective way of masking the bitterness of quinine was taught some years ago by Dr. A. Jacobi. The quinine is to be mixed in a tablespoon with enough strong black coffee, cold, to almost fill the spoon. The quinine does not wholly dissolve, but it gives the coffee the colour of *café au lait*. In this way most persons can take quinine without tasting it.]

Suppositories containing quinine are apt to irritate the rectum, and enemata are not always retained. However, when the administration of the drug by the mouth is not feasible, and when it is desired to secure a local effect upon the lower bowel, it is justifiable to give it by the rectum. Potassium iodide is chemically incompatible with the quinine salts and should never be given in combination by the rectum, since iodine is set free. For hypodermic use, as brought out above, the hydrochloride, bisulphate, and hydrobromide are to be chosen, because of their easy solubility. The first is soluble in 34 parts of water, the second in 10 parts, and the last in 54 parts. It is alleged for the hydrochloride that it is cheap, that its injection is free from pain, and that it does not produce an abscess at the site of introduction. The same statements are made for the bichloride and the compound salt of the hydrochloride with urea. The hydrochloride, however, according to Briquet, is not stable. Except in an emergency, as in insolation, or when an immediate effect is desired, it is not necessary to resort to the hypodermic needle to secure the effect of quinine. The possibility of producing an abscess by the use of an unclean needle must not be overlooked.

The dermic method of administration may be resorted to in children; but it has been shown that, although some of the quinine appears in the urine shortly after its dermic application, the greater part of the drug does not enter the blood. This method, then, is practically valueless.

The dose of quinine and its salts is elastic. It may be given for tonic effect in doses of ½ a grain; or, to produce cinchonism, the dose may be as high as 75 grains. No set rule can, therefore, be laid down. The hydrochloride is given in doses of about ⅛ less than the sulphate. The dose of the valerianate is from 1 to 2 grains. The doses of the other salts are the same as those of the sulphate, which varies with individual cases and with the diseases for which it is given. (Cf. CINCHONA.)

[An official wine of quinine, *vinum quininæ* (Br. Ph.), contains a grain of the sulphate in each fl. oz. It is given in doses of from ½ to 1 fl. oz.

Dr. Erskine B. Fullerton, of Columbus, Ohio, professor of materia medica and therapeutics in Starling Medical College (*N. Y. Med. Jour.*, August 18, 1894), urges the use of quinine in *Asiatic cholera*. He recognises that it has often been tried and found to fail, but this he attributes to its having been given in an improper manner. Ten grains, in powder, he says, diffused through a small quantity of

water, or in acid solution, at hourly intervals, until 20 to 40 grains have been given, afterward *pro re nata*, should be the ordinary instructions; the same dose at half-hourly intervals for a sufficient time in collapsed or in *foudroyant* cases; smaller doses, perhaps, at longer intervals in *choleraic diarrhœa*. There should certainly be retained, of other treatment, adds Dr. Fullerton, appliances for the restoration of heat; saline hypodermoclyses to supply lacking serum to the blood; morphine hypodermics to allay pain and cramps, with enteroclyses of quinine where, as past experience shows rarely to have been the case, the remedy is vomited; and in the sequent enteritis or otherwise persistent diarrhœa, calomel in small doses should not be lost sight of. That by so treating our patients, says Dr. Fullerton, we may hope for a mortality among collapsed and collapsing patients of about 14 to 25 per cent. only; that by earlier administration of the remedy, instead of the use of other agents that have heretofore permitted so many cases to run on into collapse and death, we may reduce the mortality in such cases to 2 to 5 per cent. only, seems a fair assumption for the best of reasons—*i. e.*, it should be so, and so far it always has been so.]

SAMUEL M. BRICKNER.

QUINOIDINE.—See QUINIDINE.

QUINOLINE, an oily alkaline liquid, C_9H_7N, obtained by distilling quinine with a caustic alkali, is colourless when pure. It has a disagreeable odour somewhat suggestive of bitter almonds, and is acrid and bitter to the taste. It is but slightly soluble in cold water, but dissolves more readily in hot water. It mixes in all proportions with alcohol, with ether, and with the essential oils. It has been employed as an *antiseptic* in a 5-per-cent. solution in equal parts of water and alcohol.

QUINOSOL, a German proprietary preparation, is described by the manufacturers as a neutral compound of oxyquinoline which, when used, gives up oxyquinoline in a nascent state and consequently of great efficiency as an *antiseptic*. R. Kossmann (*Ctrlbl. f. Gynäkol.*, December 28, 1895), states that trials of it made at the Munich Hygienic Institute go to show that it is relatively so non-poisonous that a dose of 45 grains, given to a rabbit, does not injure the animal, while a 1-to-40,000 solution prevents the development of cultures of the *Staphylococcus pyogenes aureus*. For several months, he says, it has entirely supplanted corrosive sublimate and carbolic acid in his practice, and he has seen absolutely no toxic effects due to it, or any irritation, even eczema, when it has been insufflated in powder into suppurating wounds. He further states that it does not injure the skin, even in so strong a solution as that of 1 to 500, applied repeatedly; it does give the hands a yellowish tint, but this may be removed by washing with pure water. It is free from any unpleasant odour. Kossmann thinks it would prove a safe and efficient antiseptic in the hands of midwives. Solutions of it should be of the same strength as those of corrosive sublimate. It may be had in the form of tablets which are readily soluble.

On the other hand, Ahlfeld, Vahle, and Witte (*Ctrlbl. f. Gynäk.*, February 29, 1896) report discouraging results as to its efficiency as an antiseptic and as to its being non-poisonous. Ahlfeld and Vahle found that even so strong a solution as one of 3 per cent. could not be altogether relied on. Eight grains of quinosol, injected subcutaneously into a rabbit, they report, killed the animal in eighteen hours; its blood was found to be very dark-coloured, and all the organs were dusky, especially the kidneys. Witte makes quinosol the text for some very forcible remarks about the quest for new antiseptics. In corrosive sublimate, in carbolic acid, and in lysol, he says, we have antiseptics that have been tried thoroughly; years of observation have taught us the bright and the shady side of their action. The case for quinosol, he holds, has by no means been made out. As to Kossmann's experience in the employment of the drug for a number of months without the occurrence of a single case of infection from a wound or any appearance of poisoning whatever, even so slight as eczema, he doubts if these results are to be ascribed to the quinosol. His own, he says, have been quite as good when he used only a sterile physiological solution of common salt. Furthermore, he argues, even if it is true that traumatic cavities, suppurating and yielding a fœtid secretion, may be favourably affected by quinosol, the fact is of little consequence, for the thing to do is to remove the putrefying masses and use drainage, and it makes no difference whether this or that antiseptic is employed, or, indeed, only sterile water. As to the statement that quinosol, even in substance, is in no wise irritating to wounds, his own experience, he says, has been to the contrary. In two instances he has applied quinosol in substance to the cavities left after the removal of glands, and each time such intense burning pain set in that the patient begged to have it taken out. Although he himself has not observed symptoms of poisoning from quinosol, he insists that we can not be sure they will not occur. A minor objection to quinosol is the fact that it stains the skin and the instruments, but the stain can be removed without much trouble.

Quinosol is particularly unsuitable for vaginal irrigation during labour, says Dr. Witte, for it is highly astringent, so that it would rob the vagina of its lubricity and make it rough and unyielding, as corrosive sublimate does.

QUINQUINA.—See CINCHONA.

RATANHIA.—See KRAMERIA.

RECONSTITUENTS are remedies which promote reconstitution or reconstruction. They include a variety of therapeutic means of which only a part are medicinal. Among the reconstituents are diet, exercise, climatic influences, travel, bathing, and personal hy-

giene, as well as alterative, stomachic, and tonic medicines. These, for the greater part, are considered elsewhere in this work, and it therefore remains but to point out their special actions as reconstituents.

The action of *food* as a reconstituent is pronounced, and curable *debility* of any kind yields more quickly to it than to anything else. The most striking example of its powers is observed in the *convalescence which follows acute disease*. The reconstituent power, however, does not reside in all varieties of food to the same degree; indeed, from their indigestibility, certain of the richer foods not only fail at reconstitution when given in debility, but are even productive of debility if given excessively in a state of health. Fats are, as a class, our most useful reconstructive foods, for they combine with easy digestibility a maximum power to nourish, milk, of course, offering the best example of this action, and *tuberculosis* the condition in which its benefits are most striking. Nitrogenous foods rank second to fats in reconstituent value, being both more difficult of digestion and, as a rule, less nourishing, while carbohydrates come last, though they are certainly nourishing and in many cases highly to be recommended. As in health, so also in debility, no exclusive diet is ordinarily to be advocated, but instead such a judicious mixture and combination of nitrogenous, fatty, and carbohydrate foods as experience has shown to be most useful. In some cases of debility a positive distaste for food has to be combated; the patient, if left to himself, would not consume a sufficient amount of food to maintain his nutrition. If this is the case there is often much benefit to be had from forced feeding, or *gavage*. Certain beverages may be regarded as indirectly reconstituent by virtue of the stimulating and sustaining power they exert over nerve function, especially that of digestion, and by virtue of their action to lessen tissue waste. Those which contain alcohol or caffeine are undoubtedly thus active, while some few drinks are directly reconstituent because of the food value of some of their ingredients.

That a judicious amount of *exercise* is reconstituent needs proof no more than that overwork is debilitating. Under its influence tissue metamorphosis is made more active, and elimination of waste products is increased. Digestion and absorption are in their turn augmented and, provided the food given in response to this demand is of the proper and nutritious sort, reconstruction takes place. It is not every exercise which performs this reconstructive duty, for if excessive in amount or violent in its nature, it may have quite the opposite effect—namely, to exhaust and depress. Exercise in the open air, too, is much to be preferred to exercise within doors, though the latter is not inefficient. In some cases where debility is extreme, active exercise is an impossibility, and then we may usefully employ massage and passive motion until, with returning vigour, the ability to take active exercise returns.

The influence of *climate* upon debility is great, and no more convincing proof of this is needed than the rapidity of *convalescence* which takes place when a change of air is sought, as compared with the relative slowness of recovery at home. That the different atmospheric conditions deserve some credit for this usefulness is no doubt true, but they certainly do not deserve it all, for, as in the case of treatment by mineral waters at the spring from which they are obtained, a number of factors must necessarily enter into the effect upon the patient. Of these factors the most important, besides atmospheric conditions, are change of scene and surroundings, relief from the cares of home or of business life, change of diet and occupation, change of hours, rest and repose, and, finally, a mental condition of hopefulness and expectation of benefit to be derived which in itself will favour recovery. That convalescence and debility in general should receive the benefits which change of residence will give needs no argument, but some cases are wrongfully treated thus. Of all conditions so mistreated, *tuberculosis* offers the most striking example, and we every day see patients sent from home that they may obtain the supposed benefits which change of climate can give, when it is quite evident that recovery, or even improvement, is impossible, and that deprivation of home surroundings and of home comforts to them means positive harm. The hopeless kinds and degrees of debility, therefore, should, as a rule, receive treatment at home. As to the climate which should be sought in cases suitable for climatic treatment, there are no hard and fast rules. In many cases it is change that is the important factor rather than atmospheric conditions, and then almost any climate will be suitable, provided the element of change is present. In other cases the proper climate must be sought by experiment, and therefore the patient must go from place to place until he finds a locality in which he eats, sleeps, and feels well. In certain diseases, however, one rather expects recovery to be promoted by special atmospheric conditions; thus, persons with *catarrhal diseases*, as a rule, are relieved by atmospheres which are relatively warm and dry; those with *renal diseases* also are generally improved by the same sort of climate; while those with *nervous diseases*, as a rule, are benefited by a warm and soothing air, and injured by one which is changeable in temperature and humidity, and, as a rule, by sea air. Patients with pulmonary tuberculosis are susceptible of improvement by a variety of climates, the chief determining elements being the purity of the atmosphere, the relative absence of moisture, and freedom from sudden changes. Further than these, the exact locality will be determined by the degree of debility which is present; those who are much enfeebled it is well to send to warm climates, while those whose vigour is preserved do well in the dry and cold mountain atmospheres, and for others still the suitable place must be sought by travel. In all tuberculous cases, however, the main requisite seems to be a continued out-of-door life.

Travel as a reconstituent agent may be of much benefit, and on the other hand may be productive of great harm; the determination of the question rests upon the amount of vigour which the patient possesses and his ability to withstand fatigue. Certainly nothing could be more foolish than to hurriedly and continuously drag an enfeebled man from place to place and expect him to grow strong. Not only must the strength of the patient be consulted, but also the mode of travel, for, though an invalid might well be able to travel in the luxury of a yacht or a private car, he would be no fit occupant for the springless wagon or the saddle. In *mental exhaustion from overwork* travel is certainly at its best, provided anxiety can also be left behind, and in many another disturbance it may be of the greatest benefit, but in prescribing it one must carefully consider many things, especially the patient's physical ability, the circumstances of the journey as regards comfort, the importance of the duties and interests he leaves behind, the itinerary, and the amount of benefit which it is possible for him to derive from his journeyings.

The observance of hygienic rules is highly reconstituent. This is scarcely the place to impress the importance of regularity in all which pertains to our physiological life, as concerns eating, sleeping, exercise, the evacuations, and bathing. The rules which should govern these matters are well known, and it is equally well known how violation of them may result in a debility which will return only when the violation ceases. As a reconstituent in *convalescence* and *asthenia*, generally, the *cold bath* deserves a particular mention, for its tonic power over nervous energy is very great. Whether the cold bath should take the form of sponging, of showering, or of the plunge will vary with circumstances, and for detailed information the reader is referred to the article on BATHS.

So far as reconstituent drugs are concerned, it might seem that they were sufficiently described as tonics, but reconstituents would appear to be the larger class, including not only *tonics*, but also *bitters* and *alteratives*. Alteratives certainly possess a great influence in certain cases of debility; an example of this action is seen in the *anæmia of syphilis*, where other reconstituents are of little or no effect unless *mercury* or an *iodide* is simultaneously administered. It is doubtless true that in such conditions the alterative acts in a complementary capacity to the other reconstituent, and it is perhaps more exact, therefore, to regard alteratives as reconstituents rather by indirect than by direct action. Bitters promote reconstitution by their action upon digestion, for the appetite and the assimilative power become so much enhanced under their influence that larger amounts of food are taken and absorbed, to the end that general nutrition is much improved. It is for this reason that bitters are so generally employed in debilitated states, and in the convalescence from acute disease the use of the bitter remedies, like quassia, calumba, and gentian, has become almost a routine. As reconstituents, the bitters act indirectly by virtue of their influence upon digestion; the tonic remedies act thus as well, for stomachic and digestive virtues reside in most of them, but they act more upon the body generally, though, again, digestion plays a part, for bodily invigoration includes digestive improvement, and from digestive improvement the general health is increased. The chief primary action of the tonics as reconstituents is upon the body generally, and thus iron, arsenic, and strychnine become of so much service in debility. Finally, we must class *cod-liver oil* as in the highest degree reconstituent, though the manner by which it acts is not clear. It is credited, as we know, with alterative, tonic, and nutritious qualities by any or all of which it might be reconstituent.

HENRY A. GRIFFIN.

RECTAL MEDICATION. — See under CACAO-BUTTER.

RED POPPY.—See RHŒAS.

RED SAUNDERS.—See SANDAL-WOOD.

REFRIGERANTS are agents which effect cooling, either of the body generally or of a part. Strictly speaking, no reason exists why the name refrigerant should not be held synonymous with antipyretic; it has, however, come to have the signification of producing *sensations of cold*, rather than of actually reducing the temperature of the body.

Clinically, refrigerants have two uses. The first concerns their employment as *cooling beverages*, which are often so grateful to patients suffering from fever, and are effective rather by quenching thirst than by appreciably reducing the fever. As refrigerant drinks, there may be used ice water, carbonated waters, lemonade, or water slightly acidulated with an acid, especially diluted phosphoric acid. Naturally, these drinks are more effective if used cold, and, with due regard for the amount of the acids they may contain, they may be taken freely, the sole contra-indication to their generous employment being gastric disturbance, either present or impending. Should gastric disturbance be present, the proper refrigerant will be either cracked ice or iced water given cautiously, tentatively, in small quantities and at infrequent intervals. The second clinical use of refrigerants is for the production of local and, especially, cutaneous cold for the purpose of diminishing local congestion and inflammation or of causing anæsthesia. As refrigerant applications useful in local inflammations may be cited cold water, cold air, and especially evaporating lotions. The production by cold of local anæsthesia sufficient for the performance of minor surgical operations, such as the opening of abscesses, may be brought about by the application of ice to the part; but there are certain obvious disadvantages connected with this practice which do not apply to the spraying of very volatile liquids upon the area for operation, the rapid evaporation which takes place insuring the necessary degree of cold. A number of these liquids are in use; particularly serviceable are rhigolene, ethyl chloride, and

ether. The use of such remedies must be cautious, however, because of their inflammable and even explosive nature.

The term refrigerant is used by some writers to further describe the action of other remedies. Thus, *refrigerant diuretics* are those which act as general sedatives and render irritating urine bland. This class, naturally, consists mainly of alkalies and their salts, and the term refrigerant used in this connection would seem to be more suggestive than exact. *Refrigerant diaphoretics*, too, are spoken of, the term applying to drugs which promote perspiration by reducing circulatory excitement and are especially useful in fever. Such are aconite and veratrum viride.—HENRY A. GRIFFIN.

RELAXANTS are remedies which lessen the tension of body tissues. The power to relax resides in many agents; relaxation of the skin is produced by diaphoretics, of the intestines by various cathartics, of the blood-vessels by vascular sedatives, and of the body generally by nauseants and emetics, as well as by the hot-air bath, the prolonged warm-water bath, and remedies which debilitate. All these might properly be termed relaxants, and, indeed, the name not infrequently is employed as signifying laxative, but clinically the term is oftener used in describing remedies which produce relaxation in the skin to which they are directly applied and in the tissues immediately beneath it.

Of relaxant remedies, *poultices* offer a good example, together with other and similar applications to the surface of the body which are active by virtue of their heat and moisture. Of similar effect, though by a different mode of action, are fatty substances, which when locally applied are productive of softening and relaxation, an action which is constantly made useful in the application of ointments.

The therapeutics of relaxants will have been inferred from what has already been said, and though for the relief of *cutaneous* and *subcutaneous tension* poulticing was so constantly practised formerly, it is now but little esteemed, for fear of the injury which poultices may do, but the softening action of fatty substances is constantly evoked in conditions in which the skin has become indurated, dried, or inflamed.
HENRY A. GRIFFIN.

RESINA (U. S. Ph., Br. Ph.).—See ROSIN.

RESINS.—These are peculiar principles, profusely distributed through the vegetable kingdom and almost entirely confined to it. They are mostly uncrystallizable solids, fusible but not volatile, insoluble in water, but soluble in one or more of the more volatile solvents, such as alcohol, ether, chloroform, benzin, etc. They are also soluble in volatile and fixed oils. Most of them have an acid character, which enables them to combine with alkalies to form so-called "resin-soaps," compounds which are soluble in water, and from which the resin may again be separated by acids. The nature of the resins is, as yet, not fully understood, but most of them are evidently oxidation products of certain hydrocarbons, such as terpenes, which are the chief constituents of most volatile oils. What are ordinarily called "resins," either in the classification of drugs or in pharmacy, are in most cases not pure, homogeneous, chemical individuals, but more or less complex mixtures.

Resins are most conveniently divided into "natural" and "pharmaceutical" resins. *Natural resins* are often accompanied, in their commercial form, by other proximate principles, which modify their properties to some extent and have induced pharmacologists to classify them in different ways. Flückiger's classification, which appears the most natural, is as follows:

1. *Resins mixed with gum* (true gum-resins): gamboge.

2. *Resins mixed with gum and volatile oil:* myrrh, olibanum, asafœtida, galbanum, and ammoniacum.

3. *Resins mixed with notable amounts of volatile oil:* turpentine (and its varieties, such as Burgundy pitch, etc.), elemi, copaiba, and gurjun oil. In the case of the two latter, the substance remaining after the removal of the volatile oil is a true resin. They are often (but incorrectly) called balsams.

4. *Resins proper:* common rosin (colophony), amber, sandarac, damar, Botany-Bay resin (red and yellow acaroid resin), dragon's blood, guaiac resin, mastic, shellac, and benzoin. The latter, however, does not properly belong here, as it contains other constituents, such as volatile acids.

Pharmaceutical resins are the following, which are official in the U. S. Ph.:

a. Resina copaibæ, prepared by distilling off the volatile oil from balsam of copaiba.

b. Resina jalapæ, prepared by exhausting jalap with alcohol, concentrating the tincture, and precipitating the resin by water.

c. Resina podophylli, prepared like the preceding, except that the water is acidulated with hydrochloric acid. Of all the official resins, this is the most complex in its composition.

d. Resina scammonii, prepared like resina jalapæ.—CHARLES RICE.

RESINOL.—See ROSINOL.

RESOL.—This is a German proprietary disinfectant resembling creolin, said to be made by saponifying 100 parts of wood tar with 20 parts of caustic potash and adding 20 of methyl alcohol. It seems to have been used but little, if at all, clinically.

RESOLVENTS.—See SORBEFACIENTS.

RESORBIN.—This is a German ointment basis said to be made from very pure oil of sweet almonds, wax, gelatin, soap, and water. It mixes freely with all fatty bodies, and facilitates the penetration of drugs incorporated with it through the epidermis.

RESORCIN, *resorcinum* (U. S. Ph., Ger. Ph.), *resorcinol*, or *metadihydroxybenzene*, $C_6H_6O_2$, is a diatomic phenol prepared by melting a gum-resin with caustic potash or soda. It forms colourless or slightly reddish acicular crystals of a peculiar but faint odour, a disagreeable sweetish taste, and a pungent aftertaste. It grows reddish or brownish on exposure, and should be kept in dark amber-coloured bottles. It is readily soluble in water,

in alcohol, and in ether. Applied to mucous membranes, resorcin in strong solutions is irritating and may give rise to inflammation. Taken internally in poisonous doses, it produces tremor, convulsions, unconsciousness, and paralysis of the heart and of the respiration.

In full medicinal doses (from 15 to 30 grains in twenty-four hours), resorcin acts as an *antipyretic* and *intestinal antiseptic*, but it is not so eligible as several other drugs, inasmuch as its action is apt to be accompanied by languor, nausea, and sweating.

It is chiefly as a topical application that resorcin has been found useful. Its action is *antiseptic* and *germicidal*. It may be used in solutions or ointments of from 1 to 10 per cent., or even greater strength. Thus employed, it has proved serviceable in a great number of morbid conditions. In *diphtheria* it is a valuable topical remedy, also in various inflammatory skin diseases, such as *erysipelas*, *herpes*, acute and chronic *eczema*, *lupus erythematosus*, and *psoriasis;* in *purulent* and *ulcerative affections of the mouth*, the *throat*, the *nose*, the *ear*, etc.; and in *gonorrhœa*, *leucorrhœa*, and *chancroids*.

Dr. Moncorvo, of Rio Janeiro, proceeding on the theory that *whooping-cough* is due to a microbe, has employed resorcin in that disease with great success. He sprays the larynx with a 1-per-cent. solution.

Dr. C. Boeck, of Christiania (cited in the *Rev. internat. de méd. et de chir. prat.*, November 10, 1895), has found that resorcin is very efficacious against *chilblains*, especially when the drug is associated with ichthyol and tannin according to the following formula:

Resorcin, Ichthyol, Tannin, each	30 parts;
Water	150 "

This mixture must be thoroughly shaken before it is used. The affected parts should be painted with it every night, and, after the first layer is applied, it forms in a few minutes a dry, glazed surface. Under the influence of resorcin the skin becomes shrivelled, and the chilblains, as well as the extensive œdematous tumefaction of the fingers and of the hand, disappear rapidly. However, this mixture, in spite of its great efficacy, presents certain inconveniences which may restrict its employment. It stains the skin, and the region to which it is applied will remain black for from one to two weeks after the cessation of the treatment. Sometimes the mixture is not well tolerated by subjects who have a very delicate skin, in which it produces cracks. Finally, it cannot be employed in cases of ulcerated chilblains. The following formula, which, says Dr. Boeck, is less efficacious than the preceding one, may be employed if the patient's work is such that he can not use a substance which blackens his hands:

Resorcin	60 parts;
Gum arabic	38 grains;
Water	115 parts;
Talcum powder	15 "

This mixture should be applied every night to the affected parts.

Dr. Leo Leistikow (*Monatsh. f. prakt. Dermatol.*, October 1, 1894) reports great success in the treatment of *leucoplakia* with resorcin. He uses the following paste:

Resorcin	6 parts;
Siliceous earth	3 "
Lard	1 part.

With a thin layer of cotton wound round the pointed end of a stick, this paste is to be smeared over the patches several times a day, especially after eating and before going to bed. In from eight to fourteen days the opaline patches begin to shrink and the mucous membrane becomes thin and rosy. It is now very sensitive, so that smoking and eating qiquant articles of food should be avoided and the mouth rinsed frequently with peppermint water to which borax has been added. The hyperæmia caused by the resorcin may be overcome in three or four days by applications of balsam of Peru.

REST-CURE.—Rest is one of the oldest forms of treatment in medical history. Doubtless it was the chief remedy in prehistoric times, for that matter, because Nature herself has always insisted upon it, even to the extent of inflicting many a twinge of pain on such as disobeyed her precepts. One of the most instructive books ever written on the scientific aspects of rest is that of John Hilton, who, some twenty years ago, collected in one volume, entitled *Rest and Pain*, a series of lectures delivered in the years 1860, 1861, and 1862. In this book he points out the value of rest as a curative agent. In one place he says: "So intimate is the association between rest and growth as to make them appear, on a superficial view, to stand to each other in the relation of cause and effect." In another, in relation to the increase in weight caused by rest, he says: "The value of rest in fostering the production of that highly organized animal tissue which forms so large a portion of our staple food is well known to the stock-keeper and grazier." And thus he goes on to explain how rest is the great agent in growth and also in repair, which is but a repetition of the processes of growth. Hilton applied the principles of rest chiefly to surgical disorders, but the principles are in reality applicable to many other conditions of disease. This is especially true of some disorders of the nervous system, and the phrase "rest-cure" as employed nowadays refers more particularly to a method of treatment in vogue in this class of cases, of which Dr. S. Weir Mitchell, of Philadelphia, may be considered the first and chief exponent. In 1875 he published a brief chapter in Seguin's series of *American Clinical Lectures*, entitled Rest in the Treatment of Nervous Disease, and he subsequently expanded his ideas in a small volume with the title *Fat and Blood*. He made use of the treatment in cases of *neurasthenia* and *hysteria*. Nowadays we apply the rest treatment to many varieties of nervous disorder.

The essential feature of the treatment is rest. This promotes growth of tissue and

repair of waste. To hasten the attainment of these ends, overfeeding with easily digested foods is required. A part of the principle of true rest and repose is seclusion. In order to counterbalance any ill effects due to prolonged rest in bed, and to assist in tissue metabolism, massage and the exercise of muscles by faradization are made adjuncts to the treatment. Hydrotherapy is frequently employed as an adjuvant.

With this original principle of rest as one of Nature's remedial processes in view, Dr. Mitchell evolved the system of therapy known as the rest-cure, which, as we have seen, consists in brief of rest, particular diet, artificial exercise, and isolation.

Rest.—Usually what is meant by rest in the rest-cure is absolute rest in bed for a considerable period of time—from six weeks to two months. At first, for several weeks, the patient is not allowed to sit up, read, write, or use the hands in any way, except to clean the teeth. In many cases even the bladder and bowels are to be evacuated in the recumbent posture; when the bed is to be made up, the patient is lifted to a sofa and back again; and he is to be fed by the nurse. But not all cases require such absolute rest, and the amount of rest will vary with the needs of each patient as viewed by his physician, from absolute rest through every degree of "partial" rest-cure. Thus, there are patients who are permitted to feed themselves, to get up for stools, to read, to sew, or to write a little, and others, again, who may pursue their vocations within certain hours, being required merely to add some hours to their rest by going to bed early and rising late.

Diet.—The aim in dieting the patient is to insure easy digestion and the assimilation of considerable quantities of nourishment. Milk constitutes, therefore, the major part of his food, and it is given every two hours generally, at first in small quantities, for some days (4 fl. oz.), and gradually increased until at the end of a week or ten days he takes from 8 to 12 oz. every two hours. When ordinary milk is not well borne, it may be diluted with carbonated waters or peptonized, or some digestible substitutes employed, such as kumyss, matzoon, or somal. At the end of a few days a little stale bread and butter may be given twice and subsequently thrice daily; later on, a soft-boiled egg may be added, and finally a chop or steak at noontime and boiled rice at supper-time.

The stimulant drinks (tea, coffee, cocoa, etc.) are not given, nor are beef tea, broths, soups, and the like, because the former are needless and the latter not especially nutritious.

Massage.—In order to overcome the disadvantages of lack of exercise, the muscles of the entire body are kneaded by a *masseur* or *masseuse* (preferably the nurse) for from fifteen minutes to an hour in the evening. This should be begun in persons unaccustomed to it by gentle *effleurage* for but a short period of time, and the duration of the massage gradually increased. Playfair advises its continuance for as long as three hours, but this is undoubtedly extreme.

Electricity.—The object of the use of electricity is the same as that of employing massage—to effect tissue metabolism by passive exercise of the muscles. The current should be that of the faradaic battery. General faradization of all the muscles of the body is given, either by the nurse or by the physician, each muscle being sought out and contracted a certain number of times at each *séance*. It is well not to begin at once with electricity, and when it is used to use very feeble currents at first, in order not to disturb or irritate the patient unduly at the outset. This is particularly needful when patients are sensitive and unaccustomed to the current. Besides exercising the muscles, there is probably a certain amount of "refreshing effect" in electricity, and its suggestive value is obvious.

Isolation.—The seclusion of the patient is naturally an inherent part of the theory of the rest-cure. In some cases it must be so rigid that no one sees the patient but the physician and nurse, and letters and news of the day are excluded from the sick-room. In others some relaxation of this rule may be made, but the physician must be very judicious in such exceptions. The patient may be isolated in his own home, but in perhaps the majority of cases for which the rest-cure is adopted a complete change of environment is productive of better results.

Such is, in succinct form, the idea of the rest-cure, slightly modified in minor details from its original conception by the experience of the writer. In many instances *hydrotherapeutic measures* may be added for their soothing, tonic, or stimulating effects on the nervous system, as indicated by the symptoms of individual patients. Drugs are given as required to meet special manifestations.

It is well to ascertain the weight of the patient from time to time during the course of treatment, when possible, and where this is not practicable the effects of the method may be judged by the appearance of the face, limbs, and trunk. The duration of the treatment will naturally vary with different cases. The rest-cure is not terminated suddenly, but in every instance there is to be a gradual relaxation in the regulations of treatment above described. It is of great advantage to write down specifically, for the instruction of the nurse and for the discipline of the patient, the duties for each hour of the day, the times for food, massage, electricity, recreation, hydrotherapy, and so on. It will be found that the personality of the physician and nurse will have much to do with the results of this treatment.

As to the nature of the disorders apt to be benefited by rest-cure in its absolute or modified forms, they are of many kinds. They are, taken somewhat in the order of their appropriateness, such diseases as *neurasthenia*, *hysteria*, *exhaustion* from any form of *nervous* or *mental disease*, *chorea*, *acute mania*, *melancholia*, *exophthalmic goître*, *epilepsy*, and *hypochondriasis*. But it must be remembered that there are exceptions in all classes of cases above enumerated. All neurasthenics, hysterical subjects, and other victims of nervous disorders

are not by any means to be put under such treatment. The rest-cure may be the very worst kind of therapy for some patients. The physician must exercise great judgment and discretion in selecting patients adapted for a course of seclusion, absolute repose, and overfeeding.—FREDERICK PETERSON.

RESTORATIVES may be regarded as measures or remedies to be employed when there is loss of consciousness, or temporary flagging of the vital powers, or when the condition popularly known as *suspended animation* exists, as after prolonged submersion in water. The loss of consciousness observed in *fainting* is the form oftenest met with and usually demands but little beyond a recumbent posture with the head lower than the rest of the body, a procedure which usually results in a speedy recovery; but in the cases where the return to consciousness is slow, the inhalation of the fumes of ammonia, which may be provided extemporaneously by burning close to the patient's face two or three feathers obtained from a pillow, or the internal administration of the same. In more pronounced cases it may be desirable to administer alcohol, apply counter-irritation over the heart, or even pass a ligature around one or more of the person's limbs, so as to turn the blood current toward the brain; firmly grasping the ankles or wrists may be sufficient; but, whatever is done, the utmost gentleness must be observed, lest too violent a shock be inflicted upon the temporarily weakened heart. It may be stated that in this condition and others in which alcohol appears to be indicated, the smallest amount possible consistent with the end in view—viz., stimulation of the heart's action—should be administered, as often too large a quantity will overstimulate, and shortly the condition may be worse than in the beginning. Therefore it is best to measure the dose by drops rather than by drachms, and when unconsciousness is profound to instil it into the mouth by means of a dropper and trust to its absorption by the oral mucous membrane, and of that of its vapour by the lungs rather than by the stomach. Moreover, when considerable quantities are given and none of the fluid enters the larynxa—a quite possible accident—the stomach is rarely in a condition to absorb, and when no appreciable effect upon the pulse is observed, more is apt to be given and thus a dose almost lethal in its effects is in the stomach ready for absorption as soon as the circulation is quickened. A few drops of sulphuric ether may be dropped between the lips or inhaled, or, as well as alcohol, employed hypodermically. Whatever method is employed, it is much wiser to administer only enough to cause a moderate strengthening of the action of the heart, and to repeat the dose at short intervals rather than to arouse the organ to vigorous action by a full dose.

In addition to fainting, the principal conditions in which heart stimulation is desirable are *asphyxiation from submersion* in water and *exposure to illuminating gas* or *carbonic oxide* or *dioxide* in excavations, breweries, etc. Unnecessary movements of the person are to be avoided, and, as a rule, it is much better to adopt the measures needed as near as possible to the seat of the accident, unless the weather is too inclement, rather than convey the patient to a more convenient locality. This is especially important in drowning, and the neglect of this precaution has led to many deaths which could have been prevented if the efforts at resuscitation had been undertaken immediately after the taking of the person from the water. In conditions that are not serious, all that may be necessary will be dashing cold water upon the face and exposure of the chest to the cold air, but chilling of the entire body is to be avoided. In the *asphyxia of the newborn*, immersion in a cold bath or cold-water effusions usually excite the respiratory movements. When the depression of the vital powers is great, faradization over the heart will usually strengthen its action, while the same application made to the back, over the lower portion of the lung, should stimulate the respiratory movements. Dry heat to the surface is a most efficient stimulant of both the chest and the lungs, and may be applied by bottles, etc., filled with hot water, or, when practicable, by a general hot-air bath. In applying heated objects directly to the body caution must be observed that the indifference of the patient may not prevent his appreciating too high a temperature, and thus troublesome burns be caused. Friction of the surface of the body with the hand, flannel, etc., is also useful; but when there is marked depression the person should be protected by a blanket. In the asphyxia resulting from the inhalation of illuminating gas or of carbonic oxide or dioxide, ammonia appears to be rather more serviceable than alcohol, and is the agent ordinarily kept at hand in gas works, etc. To restore consciousness in *alcoholic* or *opium coma* a mustard plaster may be applied to the nape of the neck, but should not be allowed to remain in position long, lest too great irritation be set up and sloughing result.

Among the less active restoratives may be included hot soups, tea, coffee, milk, and cocoa, which should be given in moderate amounts, as during periods of depression or fatigue the stomach is apt to reject too large quantities of fluids.—RUSSELL H. NEVINS.

RETINOL.—See ROSINOL.

RETROJECTIONS.—See under INJECTIONS.

RHAMNIN.—This name has been applied to several glucosides found in various species of *Rhamnus*, also to an American concentrated preparation of *Rhamnus purshiana*, said to be made in the same way that podophyllin is.

RHAMNOXANTHIN.—See under FRANGULA.

RHAMNUS FRANGULA.—See FRANGULA.

RHAMNUS PURSHIANA (U. S. Ph.), *rhamni purshianæ cortex* (Br. Ph.), *cascara*, or *cascara sagrada*, is the bark of the Californian

buckthorn, a bush indigenous to the Pacific slope, which has recently been introduced into the pharmacopœias. Its effects are *cathartic*, and it is especially indicated in cases of *chronic constipation*. It acts without purging, is said to irritate hæmorrhoids, and in large doses sometimes has the effect of a powerful gastro-intestinal irritant. Preparations made from the freshly gathered bark are somewhat apt to gripe, but if it has been kept for about two years this tendency disappears. In addition to its cathartic effects, it is slightly tonic to the intestinal mucous membrane, and tends to correct the constipation for which it was given.

The fluid extract, *extractum rhamni purshianæ fluidum* (U. S. Ph.), is the best preparation, and, as a rule, is most effectual when given in about drachm doses at bedtime, although some advise from 10 to 20 drops night and morning, gradually increased to 30 drops if necessary. The analogous British preparation, the liquid extract, *extractum cascaræ sagradæ liquidum* (Br. Ph.), may be given in doses of from ½ to 2 fl. drachms. The dose of the extract, *extractum cascaræ sagradæ* (Br. Ph.), is from 2 to 8 grains. Nursing infants are apt to be affected by this drug when it is taken by the mother.

Cascara amarga, or Honduras bark, is a drug having the same properties as quassia, but it is not often used, and is noted here only on account of the confusion sometimes caused by the similarity of names.

RUSSELL H. NEVINS.

RHATANHIA, RHATANY.—See KRAMERIA.

RHEI RADIX (Br. Ph.), **RHEUM** (U. S. Ph.).—See RHUBARB.

RHEUMIN.—See CHRYSOPHANIC ACID.

RHIGOLENE is a very volatile and inflammable fluid obtained in the distillation of petroleum. Probably, like nearly all similar products, it is a mixture of a number of closely allied bodies, and not of any definite chemical composition. It is used in surgery to produce *local anæsthesia*, or, rather, freezing of parts, a spray from an ordinary hand atomizer being projected upon the part to be affected. Its great volatility renders it the most effective agent for the purpose, and also requires its being kept in well-stoppered bottles in a cool place. The application of the spray is to be continued until the part upon which it is directed has become blanched and insensible to the touch. The procedure is one which may often be useful for the painless extraction of teeth and the incision into boils, abscesses, felons, etc., but, if the action of the cold extends beyond the skin, more or less sloughing of the parts will occur. The chief advantages attendant upon this method are the ease with which it can be carried out and the portability of the apparatus, but whenever it is practicable the use of nitrous-oxide gas is much to be preferred when minor surgical operations are to be performed. Rhigolene is unsafe to use in the vicinity of lights, and if considerable amounts are needed, thorough ventilation is necessary, as, when combined with air in certain proportions, its vapour is highly inflammable.

An ointment containing 16 parts of rhigolene and 1 part each of camphor and spermaceti has been recommended in the treatment of *burns;* it is spread or daubed on cotton, which is applied over the affected part.

RUSSELL H. NEVINS.

RHODALLINE.—See THIOSINAMINE.

RHODEORRHETIN. — See CONVOLVULIN.

RHŒADOS PETALA (Br. Ph.), **RHŒAS.**—The fresh petals of the red poppy, *Papaver Rhœas*, and preparations made from them, especially the syrup of poppies, *syrupus rhœados* (Br. Ph.), were formerly much used as a mild *anodyne* and *soporific*, particularly for children. The dose of the syrup is 1 fl. drachm. It is now prescribed chiefly to impart a pleasing colour to mixtures in which, such as cough mixtures, a feeble anodyne is unobjectionable.

RHUBARB, *rheum* (U. S. Ph.), *rhei radix* (Br. Ph.), *radix rhei* (Ger. Ph.), is the root of various species of *Rheum*. The U. S. Ph. and the Ger. Ph. name *Rheum officinale* only, but the Br. Ph. recognises the root as derived from *Rheum palmatum*, *Rheum officinale*, "and probably other species." The plants of this genus are native to Asia. Though certain varieties are cultivated elsewhere, medicinal rhubarb is chiefly obtained from China and Tartary. The root, having been dug up, is cleaned, divested of its cortex, cut into pieces of convenient size, perforated, and strung upon cords. In this state it is dried by exposure either to artificial heat or to the sun, sometimes both. Much obscurity surrounds the precise origin and preparation of the Asiatic root, but in commerce two sorts are recognised, the Chinese and the European. Chinese, or India, rhubarb is the one most esteemed medicinally. It occurs in irregularly cylindrical or conical, flattened pieces which are generally perforated. The object of the perforation has already been alluded to. The surface of the pieces is covered with a light yellowish-brown powder, and is frequently wrinkled. Beneath the powder the colour of the root is reddish-brown and mottled with lighter hues. The root is hard and dense, its odour is aromatic and peculiar, and its taste bitter and somewhat astringent. When chewed, the root is gritty to the teeth and stains the saliva yellow. European rhubarb, though of considerable medicinal activity, is not comparable in worth with the Chinese variety. At the present time it is little exported, and is used probably as an adulterant of the Asiatic drug. The plant has been cultivated in several parts of Europe, especially in England and France, but less now than formerly. A variety of rhubarb known as Russian, or Turkey, rhubarb was formerly exported, but is no longer to be had. Its exact origin is unknown.

The chemistry of rhubarb is not completely determined as yet. The Asiatic root contains extractive, sugar, starch, pectin, lignin, and

inorganic salts. It contains also tannic acid of the variety known as rheotannic acid; calcium oxalate, which occurs in crystals in large amount and accounts for the grittiness of the drug when chewed; and several colouring matters, among them chrysophanic acid. The existence of chrysophanic acid in rhubarb, however, has been denied, and it is stated that it occurs only when *chrysophan*, a glucoside which the drug is said to contain, is decomposed under the influence of moisture, and a supposititious ferment. A crystalline substance termed *emodin* is also described as present in the root. The medicinal power of rhubarb is thought to reside rather in the combination of constituents than in an active principle; certainly no active purgative principle has been isolated. The European varieties of rhubarb contain more tannin and more starch than the Asiatic, but far less calcium oxalate; they therefore lack much of the grittiness of the Asiatic drug on being chewed.

In small doses, rhubarb is *bitter* and *stomachic*, acting decidedly to increase digestive vigour. In larger doses it is purgative, causing loose fæcal evacuations, but, owing to its tannin, rhubarb is secondarily astringent and even constipating, a circumstance which contributes much to its medicinal value. The purgation from rhubarb has been attributed rather to its action upon peristalsis than upon intestinal secretion, though it is apparently proved that the drug is actively *cholagogue*. Occasionally it causes griping. The urine shows that a part of the drug at least is absorbed, for under its influence the colour of the urine becomes more deeply yellow. The milk of a nursing woman is apt to be made yellow if rhubarb is taken, and is said sometimes to exercise a laxative influence upon the child.

The therapeutic value of rhubarb is chiefly manifested in *atonic dyspepsia*, where it is active because of its stomachic properties, and also valuable from its influence upon the *constipation* which is generally present. In such cases the administration of rhubarb before eating, and especially in combination with an alkali like sodium bicarbonate, is highly beneficial, a fact which would seem to have abundant confirmation in the extensive use of the familiar "rhubarb-and-soda mixture" for these purposes. *Habitual constipation* may be treated with rhubarb with benefit, for, though it is indeed secondarily astringent in its action, it is not injuriously so, and its strengthening properties more than compensate for its astringency. Its mildness of action makes rhubarb a valuable purge for the enfeebled, and for the same reason it is practically worthless where revulsion or depletion is required. In *diarrhœa* of the subacute rather than of the acute variety, rhubarb is often of much benefit, serving to remove irritating materials from the intestines as well as to exert upon them an astringent and a strengthening influence. In *functional disturbance of the liver* in which biliary production is deficient, rhubarb is an excellent remedy. The drug is sometimes used in combination with another purgative, that mutual increase of activity may occur. Thus, rhubarb and blue mass may be given together when hepatic stimulation and bilious evacuation are desired, while rhubarb and aloes make an excellent cathartic combination for those who are habitually constipated, provided, as is always the case in chronic constipation, curative hygiene is not neglected. Rhubarb is but little employed topically, but it has at times been applied to *unhealthy ulcerations* in powder with supposed benefit.

The dose of rhubarb as a stomachic is from 2 to 5 grains; as a purgative, from 20 to 30 grains. Its use in substance is uncommon, though those who suffer habitually from constipation may find benefit in chewing small pieces of the root from time to time. As a stomachic, rhubarb is most frequently given in a mixture; as a purgative it may be given in a pill with soap. Of European rhubarb the dose will vary between two and three times that of the Asiatic variety. The preparations of rhubarb are numerous. Extract of rhubarb, *extractum rhei* (U. S. Ph., Br. Ph., Ger. Ph.), is a mass of pilular consistence obtained by macerating and percolating powdered rhubarb with alcohol and water and evaporating the percolate. The dose is from 5 to 10 grains. Compound extract of rhubarb, *extractum rhei compositum* (Ger. Ph.), contains 6 parts of extract of rhubarb, 2 parts of extract of aloes, 1 part of resin of jalap, and 4 parts of medicinal soap. The dose is from 2 to 5 grains. Fluid extract of rhubarb, *extractum rhei fluidum* (U. S. Ph.), is given in doses of from 5 to 10 minims as a laxative, and from 20 to 30 minims as a purgative. Infusion of rhubarb, *infusum rhei* (Br. Ph.), is composed of 1 part of thinly sliced rhubarb infused in a covered vessel for half an hour with 40 fl. parts of boiling distilled water, and the liquid strained. The laxative dose is from 1 to 2 fl. oz., and it may be repeated every three or four hours until it operates. It is incompatible with the stronger acids and with solutions of metallic salts. Pills of rhubarb, *pilulæ rhei* (U. S. Ph.), contain 20 parts of powdered rhubarb and 6 parts of powdered soap mixed with a sufficient quantity of water. Each pill contains 3 grains of rhubarb. Compound pills of rhubarb, *pilulæ rhei compositæ* (U. S. Ph.), and the compound rhubarb pill, *pilula rhei composita* (Br. Ph.), according to the U. S. Ph., are composed of 13 parts of powdered rhubarb, 10 of purified aloes, 6 of myrrh, ½ of oil of peppermint, with a sufficiency of water; those of the Br. Ph. contain 6 parts of powdered rhubarb, 4½ of Socotrine aloes, 3 of myrrh, 3 of hard soap, ½ of oil of peppermint, 2 of glycerin, and 6 of treacle. The dose of the American preparation as a laxative is from 2 to 4 pills; of the British preparation, from 5 to 10 grains. Compound powder of rhubarb, *pulvis rhei compositus* (U. S. Ph., Br. Ph.), *pulvis magnesiæ cum rheo* (Ger. Ph.), Gregory's powder, according to the U. S. Ph., contains 25 parts of rhubarb in powder, 65 of magnesia, and 10 of ginger; according to the Br. Ph., 2 parts of powdered rhubarb, 6 of light magnesia, and 1 of powdered ginger; according to the Ger. Ph., 12

parts of magnesium carbornate, 8 of oleosaccharum of fennel, and 3 of powdered rhubarb. The powder is laxative and antacid. The dose is from ½ to 1 drachm. Syrup of rhubarb, *syrupus rhei* (U. S. Ph., Br. Ph.), *sirupus rhei* (Ger. Ph.), according to the U. S. Ph., contains 100 parts of fluid extract of rhubarb, 4 of spirit of cinnamon, 10 of potassium carbonate, 50 of glycerin, 50 of water, and enough syrup to make 1,000. It is a mild cathartic of much value for infants. The dose for an infant is 1 fl. drachm. The British syrup consists of 8 fl. oz. of rectified spirit mixed with 24 fl. oz. of distilled water and percolated through 2 oz. each of powdered rhubarb and powdered coriander, and afterward evaporated to 14 fl. oz. and filtered, with the final addition to it of 24 oz. of refined sugar. The adult dose is from 1 to 4 fl. drachms. Aromatic syrup of rhubarb, *syrupus rhei aromaticus* (U. S. Ph.), contains 15 parts of aromatic tincture of rhubarb and 85 of syrup. It is an excellent laxative in diarrhœal conditions of infants; for adults it is too feeble. The dose for an infant is 1 fl. drachm, repeated every two or three hours until the movements improve. Tincture of rhubarb, *tinctura rhei* (U. S. Ph., Br. Ph.), *tinctura rhei aquosa* (Ger. Ph.), according to the U. S. Ph., is made with 100 parts of rhubarb, 20 of cardamom, 100 of glycerin, and a sufficient quantity each of alcohol and water to make 1,000. The dose is from 1 to 2 fl. drachms. The British tincture is made with 2 oz. of rhubarb, ½ oz. of cardamom seeds, ½ oz. of coriander fruit, ½ oz. of saffron, and 1 pint of proof spirit. The German tincture is made with 10 parts of rhubarb, 1 of borax, 1 of sodium carbonate, 90 of water, 15 of cinnamon water, and 9 of alcohol. The dose as a stomachic is from 1 to 2 fl. drachms; the purgative dose is from 4 to 8 fl. drachms. Vinous tincture of rhubarb, *tinctura rhei vinosa* (Ger. Ph.), is made with 8 parts of rhubarb, 2 of orange peel, 1 of cardamom, and 100 of sherry wine. The doses are a little larger than those of the tinctures previously mentioned. Aromatic tincture of rhubarb, *tinctura rhei aromatica* (U. S. Ph.), is made with 20 parts of rhubarb, 4 of cassia cinnamon, 4 of cloves, 2 of nutmeg, 10 of glycerin, and of alcohol, water, and diluted alcohol, each a quantity sufficient to make 100. The adult dose is from ½ to 1 fl. drachm. It is used in making aromatic syrup of rhubarb. Sweet tincture of rhubarb, *tinctura rhei dulcis* (U. S. Ph.), is made with 10 parts of rhubarb, 4 of licorice, 4 of anise, 1 of cardamom, 10 of glycerin, and of alcohol, water, and diluted alcohol each a sufficient quantity to make 100 parts. The dose is from 2 to 3 fl. drachms. Wine of rhubarb, *vinum rhei* (Br. Ph.), is made by macerating 1½ oz. of powdered rhubarb and 60 grains of powdered canella bark with 1 pint of sherry for seven days, straining, filtering, and adding sufficient sherry to make 1 pint. The dose is from 1 to 2 fl. drachms. There is occasionally used for diarrhœal conditions what is known as *torrefied rhubarb*. This is rhubarb from which the purgative principles have been driven off by heating, the astringent property remaining.

[The dose of rhubarb-and-soda mixture, *mistura rhei et sodæ* (U. S. Ph.), is from ½ to 1 fl. drachm for infants, and from 2 to 4 fl. drachms for adults. A more convenient form of rhubarb and sodium bicarbonate is that of the unofficial compressed tablets, from one to six of which may be taken in the course of twenty-four hours.]—Henry A. Griffin.

RHUS.—This is a genus of anacardiaceous trees and shrubs. Several of the species are poisonous, and medicinal virtues have been ascribed to some of them.

Rhus aromatica.—The root-bark of this North American shrub, the sweet sumach, is *diuretic*, and is reputed to have a stimulating action on the muscular tissue of the bladder, the uterus, and the large intestine. It has been used with considerable success in *incontinence of urine from vesical atony*, in *vesical hæmaturia*, in *metrorrhagia due to fibroid tumours of the uterus*, and in *hæmorrhage from the rectum*. The powder may be given in daily amounts of from 15 to 45 grains. There is an unofficial fluid extract of which from 10 to 30 drops may be given daily.

Rhus diversiloba, the *hiedra*, or *yeara*, or poison oak, of the Pacific coast of the United States, is similar in its poisonous action to *Rhus Toxicodendron*, which it resembles in appearance also. According to Dr. Colbert A. Carfield (*Am. Jour. of Pharm.*, September, 1860), a remedy which is invariably efficient in poisoning with *Rhus diversiloba* is grindelia (either *Grindelia hirsutula* or *Grindelia robusta*). "The mode of using it," says Dr. Canfield, "is as follows: One may bruise the fresh herb and apply it by rubbing over the parts affected, or, boiling it in a covered vessel, make a strong decoction of the fresh or dried herb with which to wash the poisoned surfaces. Its remedial properties appear to be contained chiefly in the resin or balsamlike juice of the plant, which is particularly abundant on the surface. One application is sometimes sufficient for a cure, but if the disease has been of long duration, several days will elapse before relief is obtained." Probably the fluid extract of grindelia will be found equally serviceable and more convenient as a remedy for this distressing form of poisoning.

Rhus glabra (U. S. Ph.).—The berries of this shrub, the smooth sumach, or upland sumach, indigenous to the United States and Canada, which are edible, are sour, *astringent*, and *refrigerant*. The fluid extract, *extractum rhois glabræ fluidum* (U. S. Ph.), diluted, forms an agreeable vehicle for gargles in various forms of *sore throat*.

Rhus pumila, or dwarf-sumach, a small shrub found in North Carolina, is said to be the most poisonous species.

Rhus radicans.—This is a climbing variety of *Rhus Toxicodendron*, known as poison ivy. Its poisonous effects are the same as those of *Rhus Toxicodendron*.

Rhus Toxicodendron.—Under this name, the fresh leaves of *Rhus radicans*, which is a variety of *Rhus Toxicodendron*, are official in the U. S. Ph. The poison oak, or poison ivy, is a

familiar plant of the fields, woods, and roadsides of southern Canada and of the United States. Its trifoliolate leaves serve readily to distinguish this poisonous plant, the "three-leaved ivy," from the harmless Virginian creeper (*Ampelopsis quinquefolia*) with which it might otherwise be confounded.

To most persons, *Rhus Toxicodendron* is a violent poison. Handling the plant or gentle contact with it—even, in the case of some individuals, exposure to the emanations from it, without any contact with it whatever—is enough to cause the *cutaneous form of rhus poisoning* to ensue within a few hours, in the form of an intense dermatitis. In rare instances the entire skin is affected, but usually the effects of the poison are shown only on those parts to which the plant was originally applied or on those also to which the milky juice (some say, too, the contents of the vesicles incident to the inflammatory process) may be transferred by the patient's fingers. The face and the hands are the commonest seats of the cutaneous inflammation. In its character, it may range from a mere reddening of the skin through the phases of papular and vesicular lesions up to a condition of redness, swelling, and vesication that constitutes a close counterfeit of genuine erysipelas. Whatever form the poisoning takes, it is always accompanied by distressing itching and burning. Desquamation usually closes the progress of the affection, which generally begins to decline within two or three days, and almost always in the course of a week. In severe cases, where the dermatitis is widespread, there may be a moderate degree of fever for a short time.

There are some persons to whom *Rhus Toxicodendron* is not poisonous; they can handle the plant and rub its milky juice on their skin without suffering any unpleasant effect. In some others, on the contrary, troublesome sequelæ follow upon the regular course of the poisoning, such as protracted eczema and recurrent crops of boils. Moreover, there is on record indubitable testimony going to show that, with a few individuals, one attack of rhus poisoning entails upon the victim one or more annual recurrences at about the same time in the year without any fresh exposure to the plant. Thus, Mr. E. G. Lodeman (*Garden and Forest*, cited in *Am. Jour. of Pharm.*, January, 1895), writing of his personal experience with this plant, states that the symptoms of poisoning reappeared for six years consecutively, at about the same time of the year as that in which he had been poisoned, without his having been again exposed to the plant. An attack of typhoid fever occurred in the seventh year, and for several years afterward he escaped the affection. Thinking himself then exempt from the influence of the poison, he rubbed a leaf of the plant on the back of his hand, and again for several years symptoms of poisoning recurred at the same time of the year.

The treatment of this cutaneous form of rhus poisoning consists in the administration of cooling drinks and the topical application of soothing remedies. The patient should always be cautioned against handling the affected parts, for fear of transferring some of the poisonous principle to other portions of the skin. The well-known lead-and-opium wash (see under LEAD, vol. i, page 577) is very soothing; cloths wet with it may be kept constantly applied, except to the eyes. This, however, has little if any curative action, but is only palliative. The fluid extract of serpentaria has been highly recommended as both a soothing and a curative application. It is highly probable, in view of Dr. Canfield's experience with the use of grindelia in cases of poisoning with *Rhus diversiloba* (mentioned in the section on that species), that the fluid extract of grindelia will be found of substantial service in *Rhus-Toxicodendron* poisoning. Weak solutions of carbolic acid have sometimes proved efficacious. Mr. George M. Beringer (*Am. Jour. of Pharm.*, Jan., 1895) has found hot soda baths efficacious, but for a topical application he prefers the following lotion:

℞ Granular sodium sulphite.. 1 drachm;
Glycerin ..... ½ fl. oz.;
Camphor water, enough to
make ..... 4 fl. oz.
M.

Mr. Beringer states that he has seemed to have good results from washing his face and hands with a solution of hydrogen dioxide as a preventive measure.

The bastard nettle, dead nettle, rich weed, cool weed, or silver weed, *Urtica* (or *Pilea*) *pumila*, which grows in damp, shady woods and occasionally along the roadsides, has been used for a number of summers by Dr. James Stokes, of Philadelphia (*Med. and Surg. Reporter*, November 2, 1867), in cases of rhus poisoning, and always, he says, with decided benefit, sometimes when other remedies have proved slow or almost inoperative. If possible, he obtains full-grown plants, strips off the leaves, bruises the stems, and applies the juice directly to the affected parts. The coating is to be renewed when it has become dry. In many cases, says Dr. Stokes, a complete cure is effected by one or two thorough applications.

Dr. Blackwell, of Philadelphia (*Charlotte Med. Jour.*, cited in *Indian Lancet*, April 16, 1896), urges the use of europhene, in an ointment of from 10 to 30 per cent., or that of a dusting powder of from 25 to 50 per cent. with talcum, in the treatment of rhus poisoning.

Cases of *poisoning from the internal use of Rhus Toxicodendron* are rare. In the *American Journal of the Medical Sciences* for April, 1866, Dr. J. W. Moorman, of Hardinsburg, Kentucky, relates two cases, communicated to him by a professional friend, of poisoning from eating the berries. The subjects were children, one six and the other eight years old. The quantity eaten (whether by each or by both together is not stated) was nearly a pint. In a few hours the children became drowsy and stupid, and in a short time they began to vomit, first the partially digested fruit, afterward a thick, tenacious fluid of a wine-colour. Then convulsions of different parts of the body followed, accompanied by slight delirium. The breathing was hurried; the pulse was at first

full and strong but slow, afterward small, frequent, and compressible; and the pupils were dilated. Warm water was given to promote vomiting, and afterward a large quantity of sodium carbonate [bicarbonate ?], dissolved in water, under the belief that it was an antidote. Both the children recovered, but the younger one's convalescence was very slow.

Three cases of poisoning with the root have been recorded by Dr. James Stokes (*loc. cit.*). Four children gathered what they supposed to be sassafras roots, and made a tea from them which they drank. One of them, a boy, twelve years old, broke out with a rash resembling that of measles; his face, neck, and throat were swollen, his eyes were suffused and watery, his voice was husky, he had a dry, hoarse cough, there was soreness of his throat, with intense burning extending to the stomach, he had high fever, his tongue was coated, his urine was high-coloured, scanty, and irritating, there was intolerable itching of the skin, there were nervous twitchings, and at times his mind was wandering. He had then been ailing for a week, with catarrh and general indisposition. The scarlet appearance of the eruption on the face, with incipient vesication, and a crescentic arrangement of the rash on the body, together with the fever and catarrhal symptoms, led Dr. Stokes to a reluctant diagnosis of measles. He ordered small doses of magnesium sulphate, a tablespoonful of neutral mixture every two hours, demulcent drinks, and a farinaceous diet. On his next visit he found the œdema more diffused, extending to the hands and feet; the eyelids were closed, their connective tissue was filled with serous fluid, and they seemed ready to burst; and the prepuce was so swollen as to cause difficulty in urinating. All resemblance to measles had disappeared. At his next visit, Dr. Stokes found two others of the children, girls fifteen and seventeen years old respectively, affected with the poison. It was then that he learned of the tea they had made; among the roots they showed him were some that he recognised as those of *Rhus Toxicodendron*. The fourth child, a boy, being insusceptible, did not suffer. Lead water was now applied to the affected skin, and small doses of saline purgatives were given. All the patients recovered. The time that intervened between the tea-drinking and the onset of the symptoms is not mentioned.

Therapeutics.—Rhus Toxicodendron was formerly official in several of the pharmacopœias, but it is now recognised only in the U. S. Ph., which, strangely enough, gives no preparation of it. The first edition of the Ger. Ph. authorized a tincture, *tinctura toxicodendri*, made by macerating 5 parts of the fresh leaves in 6 parts of alcohol. Dr. John Aulde, of Philadelphia, who has made two important contributions to the literature of the therapeutic use of the drug—one published in the *Medical News* for April 20, 1889, and the other in the *Therapeutic Gazette* for October 15, 1889—makes a tincture according to the directions given in the U. S. Ph. for making tinctures from fresh herbs, using 50 parts of the fresh leaves and 100 parts of alcohol. This strong tincture, the dose of which he finds does not exceed $\frac{1}{2}$ drop, he dilutes with nine times its bulk of diluted alcohol, and the dose of this weaker tincture is 5 drops.

Dr. Aulde cites Dr. Phillips as stating that rhus was first brought to the notice of the profession by Dr. Dufresnoy, of Valenciennes, in 1798, and that in 1836 it was recognised in the *London Pharmacopœia*. Dr. Phillips recommended it, both taken internally and employed topically, in various *subacute* and *chronic rheumatic affections of fibrous tissues*. Dr. Whitla and Dr. Brunton, says Dr. Aulde, have recommended it in *incontinence of urine*. In his first publication (*Med. News*, April 20, 1889) Dr. Aulde gives the condensed histories of seven cases in which he used rhus. Three of them were examples of various forms of *subacute* and *chronic rheumatism*, one was a case of *sciatica*, one was a case of *cramps in the legs* occurring at night, and two were cases of *varicose veins*. He suggests some occult relationship between rheumatism and the varicose state of the veins that gives rise to pain. In all these seven cases the employment of the remedy was promptly followed by the most satisfactory results.

In his second article (*Therap. Gaz.*, October 15, 1889) Dr. Aulde reports his continued satisfactory employment of rhus in various manifestations of chronic rheumatism. "I do not think it would be of great benefit in acute attacks," he says, "and my experience does not justify the statement that it can be depended upon invariably for relief" in chronic cases. In this article Dr. Aulde gives extracts from reports that have been made to him by other physicians, as follows: Dr. B. W. Allen, of Jernigan, Alabama, says he considers the remedy of value in *neuralgia*. Dr. T. C. Fenton, of Streator, Illinois, mentions a case of *acute rheumatism* in which four doses of the drug took away all the pain, but failed to do away with the stiffness; a case of "rheumatism of the thigh, extending to the knee," in which six days' use of the remedy gave no relief; a case of neuralgia of the face in a woman of a nervous temperament, seven months advanced in pregnancy, in which also no effect was produced; and a severe case of *sciatica* which was cured with five doses. Dr. J. B. Laidley, of Carmichaels, Pennsylvania, reports a case of severe recurrent sciatica in an aged clergyman who was a sufferer from chronic cystitis. Decided benefit seemed to be derived from the use of rhus. Dr. H. A. Mobley, of Byromville, Georgia, reports a case of sciatica in which the beneficial action of rhus was doubtful, and one of "articular rheumatism" in a weak, anæmic lad, in which the remedy acted most satisfactorily. Dr. B. Powell, of Houston, Texas, who had himself been for years a sufferer from rheumatism and *hæmorrhoids*, found the use of the remedy very beneficial as to both ailments. He began its use in a spirit of scepticism, but he says, with regard to his rheumatism: "In three days I began to feel better than I had done for months," and concerning his hæmorrhoids: "While taking the rhus I was entirely free from all rectal annoyances. Im-

mediately, however, upon stopping the medicine the piles returned." Dr. J. Richard Taylor, of Charleston, has found the drug very efficient in subacute and chronic muscular rheumatism, always tolerated by delicate stomachs, but not quite so prompt as sodium salicylate. He says, however, that its action is very rapid in relieving *muscular soreness due to hysterical convulsions.* Dr. J. W. Welch, of New Hope, Missouri, reports its satisfactory employment in a case of rheumatism and, to a lesser degree, in one of sciatica. Dr. J. B. Whitehead, of Lovingston, Virginia, reports the cure of a case of sciatica with rhus, also the apparent failure of the drug in a case of chronic rheumatism and neuralgia. In this case, he remarks, the patient thought, from the small size of the dose, that the medicine was very dangerous, and so did not take it as she should have done.

In the course of his comments on these reports Dr. Aulde says: "Dr. Powell speaks very highly of the value of rhus in connection with the pain and annoyance attending the presence of hæmorrhoids, all of which I can fully indorse. It is truly wonderful how quickly local irritations of this character and varicose veins are subdued, and my observations incline me to consider favourably the use of some drug in connection with the rhus which will favour a more active discharge of the functions of the lower bowel, from the fact that hæmorrhoids and constipation often go together. Few physicians would be willing, however, to say that there was any relation existing between rheumatism and hæmorrhoids, or between rheumatism and varicose veins; but it seems to me that a relationship can be inferred, if not demonstrated, from the results which attend the exhibition of certain remedies. Knowing that cascara sagrada has been highly extolled for the relief of rheumatism, and knowing, further, that it acts mildly as a laxative, and is thus calculated to reduce the congestion of the pelvic organs, including the rectum, I have made a combination of the rhus with cascara sagrada cordial with the happiest effects."

Rhus venenata.—This species, the swamp sumach, is reputed to give rise to severer poisoning than that caused by *Rhus Toxicodendron.* The treatment is the same.

Rhus vernicifera.—This is the plant from which Japanese lacquer is made. According to Mr. Beringer (*loc. cit.*), Mr. D. P. Penhallow reports serious poisoning resulting from stirring and smelling the lacquer. He says that after a few experiences it was always possible for him to ascertain whenever he came into an atmosphere charged with the poison. This was manifested by a well-defined acid taste in the mouth and a slight, somewhat acute pain directly between the eyes, which were invariably symptoms of the results to follow. The Japanese, he says, employ the flesh and juices of a fresh giant crab, the *Macrocheira Kæmpferi*, and apply it freely to the poisoned parts.

RICE.—Rice is the grain of *Oriza sativa*, a grass derived originally from India. It is now largely produced in the Southern United States and in southern Europe. It contains a larger proportion of starch than any of the other cereals and a smaller proportion of proteid, fat, and mineral matter. Its composition, according to Bauer, is as follows: Proteids, 7·81; fat, 0·69; starch, 76·40; cellulose, 0·78; ash, 0·09; water, 13·23. According to Gautier's analysis, it contains 78·1 per cent. of carbohydrates, while others have placed the portion of them as high as 80 per cent. It is therefore the simplest in its composition of all the cereals, and is one of the most digestible of vegetable foods. But one hour is required for the digestion of boiled rice. Its nutritive value is less than that of wheat and the other cereals. It is unirritating, and is often tolerated by the stomach when other vegetable food will not be retained. It is therefore well adapted for the nourishment of invalids. The addition of milk or cream renders it more nutritious by supplying the elements which are lacking in the rice. Rice water is considerably used as a demulcent drink. It is prepared by boiling whole rice in water and straining off the clear liquid.—FLOYD M. CRANDALL.

RICINUS.—The leaves of the castor-oil plant (*Ricinus communis*) have by some writers been credited with *galactogenic* properties. The method usually recommended for their employment is as follows: The breasts are first bathed for fifteen or twenty minutes with a decoction of the fresh leaves. A fomentation of the boiled leaves is then applied to the breasts and allowed to remain till they are dry. If the desired result is not accomplished within a few hours, the process is repeated. The extract of the leaves, smeared over the breast and covered with a common poultice, has been used instead of the leaves themselves. Routh recommends the internal administration of a decoction of the leaves and stalks of ricinus as a galactagogue. He says that its effects are frequently immediate, yet in some cases are not observed for several days. On ceasing its use the secretion is liable to again become scanty or even to stop altogether. In modern obstetric practice the castor-oil plant is seldom or never employed as a galactogenic agent. (Cf. CASTOR OIL.)—CHARLES JEWETT.

ROSA CANINA, ROSA CENTIFOLIA, ROSA DAMASCENA, ROSA GALLICA.—See ROSE.

ROSANILINE HYDROCHLORIDE, ROSEINE.—See FUCHSINE.

ROSE.—The fruit of the dog-rose (*Rosa canina*), known as hips, *rosæ caninæ fructus* (Br. Ph.), beaten to a pulp and deprived of its seeds, is employed in the preparation of confection of hips, *confectio rosæ caninæ* (Br. Ph.), which is used in making pill masses.

The hundred-leaved rose (*Rosa centifolia*) is the species of which the petals, *rosa centifolia* (U. S. Ph.), *rosæ centifoliæ petala* (Br. Ph.), *flores rosæ* (Ger. Ph.), are used in the preparation of compound syrup of sarsaparilla, *syrupus sarsaparillæ compositus* (U. S. Ph.), rose water, *aqua rosæ* (Br. Ph., Ger. Ph.), oil of roses, *oleum rosæ* (Ger. Ph.), and honey of roses, *mel rosatum* (Ger. Ph.).

The damask rose, *Rosa damascena*, furnishes the oil, or attar, of roses, *oleum rosæ* (U. S. Ph.), which is used in the preparation of a strong rose water, *aqua rosæ fortior* (U. S. Ph.). This diluted with distilled water, forms ordinary rose water, *aqua rosæ* (U. S. Ph.), which enters into the composition of rose ointment or cold cream, *unguentum aquæ rosæ* (U. S. Ph.). Of the official rose waters, that of the U. S. Ph. is the most elegant. It is employed as a flavour in cooking, as a perfume, and as a vehicle for collyria. Collyria made with rose water are less irritating to the eyes, other things being equal, than those made with plain water.

The red rose, *Rosa gallica*, is the variety the petals of which, *rosa gallica* (U. S. Ph.), *rosæ gallicæ petala* (Br. Ph.), are used in the preparation of confection of roses, *confectio rosæ* (U. S. Ph.), *confectio rosæ gallicæ* (Br. Ph.), acid infusion of roses, *infusum rosæ acidum* (Br. Ph.), fluid extract of roses, *extractum rosæ fluidum* (U. S. Ph.), honey of roses, *mel rosæ* (U. S. Ph.), and syrup of roses, *syrupus rosæ* (U. S. Ph.), *syrupus rosæ gallicæ* (Br. Ph.). The petals of the red rose were formerly used as a *tonic* and *astringent*, but are now chiefly employed to impart an agreeable odour and flavour to preparations to which astringency is no drawback.—Russell H. Nevins.

ROSEMARY.—The volatile oil of rosemary (*Rosmarinus officinalis*), the *oleum rosmarini* of the pharmacopœias, acts topically as a *rubefacient*, and is added to rubefacient preparations on account of its agreeable odour. Given internally, in doses of from 1 to 4 minims, on sugar or diluted with hot water, it is *carminative*. The dose of spirit of rosemary, *spiritus rosmarini* (Br. Ph.), is from ½ to 1 fl. drachm. The compound ointment of rosemary, *unguentum rosmarini compositum* (Ger. Ph.), which contains 1 part each of oil of rosemary and oil of juniper, 2 parts each of yellow wax and oil of nutmeg, 8 parts of mutton suet, and 16 parts of lard, is useful as a mild stimulant to *indolent ulcers*.

ROSIN, or *colophony*, *resina* (U. S. Ph., Br. Ph.), *colophonium* (Ger. Ph.), is the resinous residue left after the volatile oil is distilled off from turpentine. It is employed in the form of ointments and plasters for its topical stimulating effect. The official preparations are a cerate, *ceratum resinæ* (U. S. Ph.), a plaster, *emplastrum resinæ* (U. S. Ph., Br. Ph.), commonly called adhesive plaster, and an ointment, *unguentum resinæ* (Br. Ph.). The cerate, which is known also as *basilicon ointment*, is much employed as a dressing for *indolent ulcers*, especially those following *burns*.

ROSINOL, *resinol*, or *rhetinol*, $C_{32}H_{16}$, is a thickish yellow oil obtained by the dry distillation of Burgundy pitch. It dissolves salol, camphor, cocaine, codeine, chrysarobin, balsam of Peru, creosote, iodol, phosphorus, oil of cade, and carbolic acid, and mixes readily with other oils. It does not become rancid and does not irritate the skin. It is an *antiseptic*, and has been employed topically, undiluted, in the treatment of *vaginal* and *uterine catarrh*, *hæmorrhoids*, *foul ulcers*, and *pruritus*.

ROSMARINUS.—See Rosemary.

ROTTLERA.—See Kamala.

RUBBER, *elastica* (U. S. Ph.). This, as met with ordinarily, occurs in three colours, black, white, and red, the exact shade of each depending upon the methods employed in its manufacture, and upon the diluent always found except in the purest varieties, which, however, are suitable only for articles in which great elasticity and flexibility are necessary. As a rule, the ordinary specimens of manufactured rubber contain carbon, zinc oxide, and lead carbonate or antimony sulphide in varying proportions; in some instances the percentage may run as high as sixty. In the cheaper rubber dolls, etc., zinc oxide is the diluent, but it is so evenly distributed through the rubber that even if particles of the toy reach the stomach no ill results are apt to follow. The same may be said of the antimony sulphide which is employed to give a reddish colour to rubber. According to the amount of sulphur employed and the degree of heat and pressure to which rubber is subjected, it approaches glass in hardness, or may be as soft and flexible as kid. From the hard variety, or "vulcanite," are made drainage-tubes, bougies, pessaries, syringes, basins, etc., and similar objects which it is desirable to cleanse easily and which should be non-absorbent. It is also a poor conductor of heat, and on that account is preferable to metals for the nozzles of douche-bags, syringes, etc., which are used to inject hot fluids into the vagina and other cavities.

From the softer variety, often termed pure rubber, are made catheters, bougies, drainage-tubes, and other objects for introduction into small canals, etc., the interior of which might be bruised or lacerated by a hard material and which are tortuous and not easily followed by a rigid instrument.

The uses of rubber tubing are almost without number. It occurs in many forms, varying from a white colour to a dead black; the former is but little elastic and rapidly deteriorates, while the latter is of such consistence as to barely maintain its tubular form and will retain its properties for years. The heavy white variety is employed as a tourniquet in surgical operations and may be substituted with advantage for a cord to encircle a part to check *hæmorrhage* or prevent the absorption of the poison introduced by the *bites of venomous snakes* or *rabid animals*. Care must be exercised that too great pressure is not exerted, as paralysis of the motor or sensory nerves may follow. Solid cords or bands may be employed in place of the tubing for the above-mentioned purposes and also to encircle the bases of small morbid growths, such as *hæmorrhoids*, with the view of causing a stasis of the circulation and a resulting shrinkage of their bulk or even gangrene. *Fistula of the anus* and fistulæ in other localities, when an operation will not be submitted to, may be treated by passing a cord or strip of rubber, called an elastic ligature, through the tract and tying it upon the surface, the tension being increased each day until the tissues are cut through. If the surfaces

are not fibrous and indurated, success usually follows this method, but it is rather tedious and troublesome, and is hardly to be undertaken unless there is good reason for avoiding an operation.

Sheet rubber is usually of about the thickness of blotting paper and should be of considerable elasticity, as its uses largely depend upon that property. It may be employed to exert moderate pressure upon *varicose veins*, *small aneurysms*, and *old intractable ulcers*, especially of the leg; in the place of elastic webbing, to sustain *weak* and *injured joints* and to expedite the absorption of *effusions in injuries to joints* and to expel the blood from limbs preparatory to operations. In this last case it should be applied from the distal end of the member toward the central, and need not remain in position longer than a few seconds, care being observed that it is applied in such manner that only very moderate pressure is exerted. Before its removal, two or three turns of tubing should be applied a short distance above its upper boundary and allowed to remain until the operation has been concluded and all bleeding vessels have been ligated. This method is hardly applicable when pus cavities or abscesses exist, as there might be some danger of pus absorption. Narrow strips may be substituted for adhesive plaster in the treatment of *varicocele* and *hydrocele*, but too great pressure is to be avoided. One point which must be borne in mind in the use of elastic bandages over any considerable extent of surface is the liability to the occurrence of more or less severe headache, which may often prevent their employment.

Elastic webbing or heavy cloth containing fine rubber cords is rather stiffer and less manageable than sheet rubber. It absorbs fluids and loses its elasticity in a shorter time, but may be employed for the same purposes. Combined with silk and other fibre, rubber constitutes the cloth from which elastic stockings, anklets, etc., are made, which are employed to exert moderate pressure over varicose veins and upon joints into which there is effusion or which have sustained injuries. When used for any of these purposes, it is rarely that they should not be removed during the sleeping hours and the parts that have been covered by them rubbed with the bare hand, as otherwise the nutrition of the tissues will be impaired. In joint affections these bandages should be used with great caution, for if they are worn too long the vitality of the joint is lowered and in some instances its usefulness has been entirely destroyed. Bandages for the support of the abdomen in pregnancy and in the obese are often worn and without any evil results.

Rubber tissue, or rubber in very thin sheets, when applied to the surface of the body, tends to keep it warm and moist, and is employed in the treatment of *eczema* and *psoriasis*, to protect *burns*, to relieve the pain of *rheumatic joints*, to cover poultices, and as a protective and covering in surgical practice. Several thicknesses wound over a *corn* will soften it in the course of two or three days so that it may easily be picked out. Wherever two surfaces of rubber tissue come together, the application of a piece of warm metal will cause them to adhere and thus an air-tight and water-tight covering may be made. A proprietary adhesive plaster is also made from rubber which the heat of the body renders adherent.

The uses of the various appliances, such as hot-water bags, etc., which are made from rubber are so familiar that they need little more than passing mention. They are simply convenient vehicles for the application of heat and cold.

Rubber sheeting is largely employed as a protective of the bedclothing, etc., in childbed, in affections in which there are offensive discharges, in fevers when baths, etc., are given, and in a host of other conditions that occur during illness. It, however, should never be allowed to come in direct contact with the person, but a sheet or blanket must be interposed.

Condoms may be used for small ice bags, and are very convenient in small contusions, affections of the eye, etc., where the application of cold is indicated.

To preserve rubber articles they should be kept in a cool and moderately moist place, two surfaces should never come together, and, if possible, a little French chalk should be dusted upon them.

[Soft rubber is very much injured by prolonged contact with fatty matters. When any such material has lodged on the rubber, it should be washed off with ammonia water, and it is well to keep small articles of soft rubber immersed in ammonia water when they are not in use.]—RUSSELL H. NEVINS.

RUBEFACIENTS.—See under COUNTER-IRRITANTS.

RUBIDIUM.—The salts of this metal bear a close resemblance to those of cæsium and those of potassium. The *iodide*, RbI, has been recommended as a substitute for potassium iodide in cases in which the potassium salt is taken only with great repugnance or in which it deranges the digestion. Rubidium may be given in doses of from 5 to 15 grains, three times a day, in *syphilis* and in other affections for which the iodides are employed. Topically, a solution of 1 part in 20 parts of distilled water has been used as a lotion for mucous surfaces.

A *double bromide of rubidium and ammonium*, $NH_3.RbBr_2$, has been recommended as a remedy for *epilepsy*, to be given in daily amounts of from 1 to 2 drachms. It is readily soluble in water.

RUBUS.—This genus of rosaceous shrubs includes the blackberry, raspberry, dewberry, etc. The rubus of the U. S. Ph. is the root bark of *Rubus villosus*, the blackberry, which is mildly *astringent*, and is employed in *atonic diarrhœa*. The dose of the powder is from 20 to 30 grains; that of the fluid extract, *extractum rubi fluidum* (U. S. Ph.), is from 20 to 30 minims; that of the syrup, *syrupus rubi* (U. S. Ph.), is from 1 to 4 fl. drachms.

Rubus idæus (U. S. Ph.), the raspberry, is employed in the form of a *refrigerant* and

flavouring syrup, *syrupus rubi idæi* (U. S. Ph.), *sirupus rubi idæi* (Ger. Ph.).

RUE (*Ruta graveolens*) is a perennial herbaceous plant of southern Europe and the Levant. The leaves chiefly are used in medicine. As their quality is impaired by drying, the oil, *oleum rutæ* (Br. Ph.), is the only preparation commonly used. It is a colourless or greenish-yellow liquid of a characteristic aromatic odour, a pungent, bitterish, disagreeable taste, and neutral reaction. It is soluble in an equal weight of alcohol. When applied to the skin, it causes heat and irritation, and may even produce vesication. Its physiological actions are similar to those of savine. It is employed for much the same purposes as savine and tansy. It is used chiefly in *amenorrhœa*, *hysteria*, and *epilepsy*. It is especially indicated in *ovarian* and *uterine atony*. In ordinary doses, it produces a sensation of warmth in the stomach, and is followed by slightly increased action of the heart. In toxic doses, it produces violent gastro-intestinal symptoms, which are followed by prostration, strangury, and, in extreme cases, convulsions. Owing to its disagreeable taste and its uncertainty of action, it is now but little used in medicine, other drugs having almost completely usurped its place. The dose of the oil is from 2 to 5 drops.

FLOYD M. CRANDALL.

RUM is an alcoholic liquor obtained by the distillation of molasses, skimmings from cane-sugar kettles, and other by-products of sugar manufactories after having undergone fermentation. When fresh it is nearly colourless, but various shades, varying from a deep claret to a pale straw, are imparted to it from the casks in which it is stored. Two varieties are found, the one being made from molasses and the other from kettle skimmings, etc., which come respectively under the general heads of New England, or Medford, and Jamaica. Of the latter, many varieties are found, named Santa Cruz, Barbadoes, etc., according to the points of manufacture, but they differ in little but name, and are as a rule dark-coloured, while the Medford variety is straw-coloured. Usually an unadulterated specimen will contain about 50 per cent. by volume of alcohol and be of a peculiar rank taste which is objectionable to many, but, as a rule, the disgust it excites at first is soon overcome. Of all spirits, rum is by far the most easily obtained free from adulteration, contains less fusel oil and other deleterious bodies than whisky, and is, in addition, much cheaper. It is usually easily digested, and appears to be less apt to undergo the acetous fermentation in the stomach than other spirits. It may be administered in the same manner as other alcoholics, but seems to be better relished when taken with considerable milk.

Pineapple rum is rum to which cut pineapple has been added in the casks and allowed to remain for several months. It has a slight flavour and odour of that fruit. Rum-shrub is sweetened rum, flavoured with the essential oils of lemon and orange, to which lemon- or orange-juice or tartaric acid is added to suit the taste. By soaking the common black wild cherry for several weeks in an equal bulk of the spirit, what is known as cherry rum is made, which is very palatable to many persons, but ranks rather as a liqueur than as a plain spirit, and is rather severe upon the stomach unless taken in small amounts.

RUSSELL H. NEVINS.

RUMEX (U. S. Ph.) is the root of *Rumex crispus*, the yellow dock, and of some other species of *Rumex*. It is moderately *astringent* and *stomachic*. It is hardly used now, except in domestic practice. The fluid extract, *extractum rumicis fluidum* (U. S. Ph.), may be given in teaspoonful doses.

RUTA GRAVEOLENS.—See RUE.

RYE.—Rye flour, the flour of the grain of *Secale cereale*, is much employed in making bread, particularly in continental Europe. When sound, it is wholesome and nutritious, but cases of poisoning have sometimes occurred from meal made from ergoted rye (see ERGOT). Rye mush is occasionally employed as a *laxative* article of diet in cases of *habitual constipation*. The dry flour, dusted on to the skin, has a soothing effect in cases of *burns* to the degree of rubefaction, and in *acute dry eczema* and *erysipelas*.

SABADILLA (Br. Ph.), or *cevadilla*, is the dried ripe seeds of *Schœnocaulon officinale*. It is now used only as a source of veratrine.

SABBATIA.—One species of this American genus of gentianaceous plants, *Sabbatia angularis*, was formerly official. Together with *Sabbatia paniculata*, it was used as a *bitter tonic* and *appetizer* and as a remedy for *malarial fevers*. An infusion of 3 parts of the plant in 10 of water may be given in daily amounts of from 1 to 2 fl. oz.

SABINA.—See SAVINE.

SACCHARIN, *gluside*, *glusidum* (Br. Ph.), or *neo-saccharin*, is a derivative of coal tar and is two hundred times as sweet as cane sugar, for which it has been proposed as a substitute in conditions in which the latter is contra-indicated. It may apparently be used as a sweetener of food for indefinite periods without ill results, and is excreted unchanged in the urine. It appears also to have acid properties and unites with the bitter alkaloids, such as quinine, strychnine, etc., to form bodies, possibly salts, which are in a measure destitute of the bitter properties of the bases, of which they contain on an average about 60 per cent. In addition, it is *antiseptic*, but to no marked degree. Solutions of it have been employed to some extent as injections in the treatment of *purulent affections of the ear*, and a ½-per-cent. alcoholic solution is useful as a wash in *aphthous sore mouth*. In large amounts it retards gastric and intestinal digestion, but proper doses are regarded as having no such effect. As it is very insoluble in water, 3 parts may be combined with 2 of sodium bicarbonate,

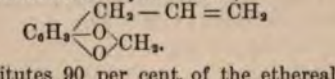
forming what is known as "soluble gluside" or "soluble saccharin," or "sodium saccharinate," which is readily soluble in water. As might be expected, it is largely substituted for sugar in the diet of persons suffering from *diabetes mellitus*, to sweeten tea, coffee, etc., and to overcome the insipidity of the various breads made from gluten. While, of course, it does not overcome the natural physiological craving for sugar, it unquestionably is of decided value. It may also be employed in the treatment of *obesity* and *indigestion*, both gastric and intestinal, where it is evident that saccharine and starchy foods excite and aggravate the trouble, and, being compatible with pepsin, it may be administered simultaneously with that substance. Lemonade may be sweetened with it when sugar would be objectionable. It can not, however, be regarded as a true physiological substitute for sugar, or substituted for it in cooking, as it is powerless to supply to the system the carbon contained in sugar. The daily amount of saccharin which may be given without interfering with digestion is about 20 grains, combined with the food.—RUSSELL H. NEVINS.

SACCHARUM.—See SUGAR.

SACCHARUM LACTIS.—See SUGAR OF MILK.

SAFFRON.—This drug, the *crocus* of the pharmacopœias, is almost disused, and it is said that it is to be omitted from the next edition of the Br. Ph. Saffron is slightly *carminative*, but is chiefly used to impart a pleasing colour to mixtures. The tincture, *tinctura croci* (U. S. Ph., Br. Ph.), may be given in doses of from 1 to 3 fl. drachms.

SAFROL.—This oily liquid, which readily crystallizes and is called also *shikimol*, has the same chemical constitution, according to Hefftter (*Arch. f. exp. Path. u. Pharm.*, XXXV, 4, 5, 1895; *Fortschr. d. Med.*, March 1, 1896), as allylpyrocatechin methylene ether,

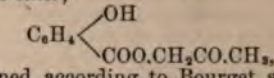


It constitutes 90 per cent. of the ethereal oil distilled from sassafras root, and is said to be present in a great variety of lauraceous and monimiaceous plants. It smells like sassafras oil. On oxidation it is converted into piperonylic acid. This change takes place to some extent after its ingestion, but for the most part it is exhaled unchanged from the lungs in the form of vapour. Safrol does not irritate a part to which it is applied, but it is highly poisonous, lowering the blood-pressure, abolishing the reflexes, and causing stupor. The subacute form of safrol poisoning closely resembles phosphorus poisoning, especially in being accompanied by fatty degeneration of many of the internal organs, notably the liver and the kidneys, with pronounced jaundice. The fatal dose, in experiments on animals, has been found to be 15 grains for each kilogramme (about 2·2 pounds) when administered by the mouth or subcutaneously, and 3 grains when injected into a vein. Safrol has been employed to a limited extent as a *stomachic* and *carminative*, in doses of from ½ to 1 grain. The crystallized form, known as *sassafras camphor*, has the same effect as thymol exerts when applied topically for the relief of *neuralgia*.

SAGE.—See SALVIA.

SAGO is a starch derived from several species of palms, especially *Metroxylon Sagu*, a native of Ceram, Borneo, Sumatra, and other islands of the Indian Archipelago. In some of these regions sago is the chief article of food. The stems are cut from the tree and split open, and the starch is removed from the centre. This pith is placed in receptacles having a sieve-like bottom, and the cellular tissue is entirely washed away. The starch is reduced to a thick, moist mass, and rubbed through sieves. It is thus formed into grains and is then dried, and finally polished in rollers by friction. It appears in the shops in round granules, usually opaque and white, with semi-translucent spots. This is known as pearl sago. It also appears in other forms. Coarse granulated sago from India is sometimes called tapioca, a term which is properly applied to another substance. Sago is not wholly soluble in hot water, but swells, forming a light, nutritious food very easy of digestion. It has no medicinal properties, and is used solely as a food. The method of preparing it is practically the same as that of the other forms of simple starch.—FLOYD M. CRANDALL.

SALACETOL, or *salicylacetol*, or *acetol-salicylic ether*,



is obtained, according to Bourget and Barbey (*Therap. Monatsh.*, December, 1893; *Nouveaux remèdes*, March 8, 1894), by heating monochloracetone with salicylate of sodium. It crystallizes in the form of scales or brilliant needles. It is slightly soluble in hot or cold water, and dissolves in hot alcohol, in ether, in carbon sulphide, in chloroform, in benzol, etc. It has a slightly bitter taste, and melts at 160° F. Shaken up with an alkaline liquid, for example, a 0·6-per-cent. solution of caustic soda, it is dissolved and saponified—that is, it becomes split up into its component parts.

Passing into the intestine, it becomes split up into acetol and salicylic acid. The latter is rapidly resorbed, the urine showing traces of it in a quarter of an hour after the administration of 15 grains of salacetol. Castor oil accelerates the absorption of salacetol. When it is given in the form of a powder, in a dose of 30 grains, from 8 to 9 grains of salicylic acid are found in the urine twenty-four hours afterward, but if it is given dissolved in about an ounce of castor oil, at the end of twenty-four hours from 12 to 13 grains are found. The causes of this increase of the rapidity of absorption are, on the one hand, the slightly irritating action of castor oil, which gives rise to a more abundant secretion of the intestinal juice, consequently splitting up the salacetol in a more energetic manner, and, on the other hand, its rendering the intestinal peristalsis more active.

The absorption of salacetol through the skin depends upon the substance in which it is incorporated. Salacetolized vaseline is not absorbed at all, while salicylic acid may be found in the urine in from three to four hours after friction with salacetolized lard. Salacetolized lard with 10 per cent. of oil of turpentine, and a solution of salacetol and chloroform in which lard and a small quantity of lanolin have been incorporated, are also completely absorbed.

Salacetol is recommended as an intestinal antiseptic. Given in daily amounts of from 30 to 45 grains, dissolved in castor oil, it has produced good results in *choleraic diarrhœa*. The intestine is disinfected as early as the third day. If the diarrhœa continues, the same dose is repeated. At the beginning of the third day salacetol alone is prescribed. Children can take 1½ grain for each year of their age.

In *acute articular rheumatism* the administration of 30 grains is followed in two or three hours by a falling of the temperature and lessening of the pain. If this dose is repeated from two to four times a day, the temperature becomes normal, and convalescence sets in as early as on the fourth or fifth day. The following ointment is recommended by Bourget and Barbey for the affected joints:

Salicylic acid,	
Oil of turpentine,	
Lanolin, each.....	150 grains;
Lard.....	1,500 "

Salacetol is given internally at the same time, in doses of 15 grains, morning and evening. They have obtained excellent results with this treatment. *Muscular* and *chronic rheumatism* also have been treated successfully with salacetol, and favourable results have been observed in cases of *biliary lithiasis* from the use of this drug dissolved in castor oil. In these cases 30 grains of salacetol, dissolved in almond oil or (especially in winter) in cod-liver oil, were given every day for three or four weeks. They think that salacetol may replace with advantage all other salicylized preparations, and they recommend its employment especially for children.

SALACTOL, or *salaktol*, is a German proprietary mixture of sodium salicylate, sodium lactate, and a 10-per-cent. solution of hydrogen dioxide. It was introduced by Wallé (*Dtsch. Med.-Ztg.*, November 15, 1894; *Brit. Med. Jour.*, December 15, 1894), who reported fifty-two cases of *diphtheria*, of all grades of severity, treated successfully by carefully and systematically pencilling the affected parts of the throat with the mixture every four hours. Diluted with its own bulk of water, it was employed also by Wallé as a gargle and in the form of spray.

SALAZOLON.—See SALIPYRINE.

SALEP, *tubera salep* (Ger. Ph.), is the dried tubers of various Oriental and German orchids, such as *Orchis mascula*, *Orchis militaris*, *Orchis Morio*, *Orchis ustulata*, *Anacamptis pyramidalis*, and *Platanthera bifolia*. According to Dragendorff, salep contains 48 per cent. of mucilage, 27 per cent. of starch, 1 per cent. of sugar, and 5 per cent. of albumin. It is *demulcent* and *nutrient*. The mucilage, *mucilago salep* (Ger. Ph.), is made by shaking 1 part of salep, in moderately fine powder, in a bottle with 10 parts of water, and adding 90 parts of boiling water. It should be prepared extemporaneously as it is wanted.

SALERATUS.—Potassium or sodium bicarbonate (see under POTASSIUM CARBONATES.)

SALICIN, *salicinum* (U. S. Ph., Br. Ph.), is a neutral principle, derived from the bark of the willow tree, principally *Salix alba* and *Salix Helix*, and from the bark, leaves, and flowers of *Populus tremula*. Although it had been previously described, it was first identified by Leroux in 1830. Its graphic formula is $C_{13}H_{18}O_7$, and it may be synthetically prepared. Salicin is not hygroscopic, remaining permanent on exposure to air. It occurs, when it is pure, in two forms, as colourless, flat plates or rhombic prisms, or as white, shining scales or needles. Its reaction in solution is neutral. It has a very bitter taste, which remains in the mouth for some time after its administration, but a solution is inodorous. At 59° F. salicin readily dissolves in 28 parts of water. It is also soluble in ether, in chloroform, in benzene, and in alkaline fluids. The melting point of salicin is 388·4° F. Salicin burns without an ash, by which test its freedom from mineral impurities may be ascertained. Salicin is a glucoside, and its difference from alkaloids, also the absence of alkaloids, may be demonstrated by the test of the U. S. Ph., which demands that a small portion of salicin be heated in a test tube until it assumes a brown colour; a few cubic centimetres of water and a drop of a solution of ferric chloride are then added. A violet colour is then taken by the solution. The aqueous solution must not be precipitated by tannic or picric acids.

Upon the temperature of the body in health, salicin exerts no influence. Given in fever, however, it has a *thermolytic* action which corresponds to that of salicylic acid, although it is much slower. In full medicinal doses, its administration is followed by a dull, apathetic expression of the countenance and by flushing of the face on the slightest irritation or excitement. Less constantly, temporary deafness, tinnitus aurium, and frontal headache supervene. A tremor of the hands and a rapid increase in the respiratory rate have sometimes been observed. After very large doses, more serious phenomena present themselves. There are severe headache, muscular weakness, tremor of the extremities, and mental irritability. The voice may become husky, and the movements of respiration are augmented in number without the appearance of dyspnœa. Salicin in such doses may cause enfeeblement of the heart's beat, with a pulse which corresponds to the rapidity of the respiration. The pulse may intermit. Like salicylic acid, salicin has provoked hæmorrhages. Emetocatharsis may follow an overdose, and, after its long-continued use, a gastric catarrh may supervene. It produces sweating, rendering this secretion

alkaline or neutral. Salicin is excreted by the kidneys, appearing in the urine in from fifteen to thirty minutes after its ingestion. The elimination of the drug is very slow, however, as traces of salicylic acid have been found in the urine sixty hours after the administration of a single dose. In the urine it appears as salicin, salicylic acid, salicyluric acid, and saligenin.

Lederer, of Munich (cited in *N. Y. Med. Jour.*, April 11, 1896), and Attfield (*Chemistry, General, Medical, and Pharmaceutical*, Philadelphia, 1883), maintain that salicin consists of saligenin and glucose, into which it splits up in the system, saligenin being the active principle. Senator, however (*Lancet*, July 17, 1879), records his belief, based on experiment, that salicin is converted into salicylic acid in the blood. Until this conversion takes place, the influence of salicylic acid—which Senator believes is the action of salicin—must be retarded. This observation corresponds with the clinical phenomena which are manifested after the administration of salicin and with the findings in the urine following ingestion of the drug. Arguing from this standpoint also, Haig logically asks why salicin should be administered when it depends upon its transformation into salicylic acid for what favourable action it exerts (*Med.-chirurg. Trans.*, London, 1890, p. 287). He urges that the compounds of salicin and salicylic acid exert a curative power in rheumatic affections which is directly proportional to their power of eliminating uric acid from the system, and that they cure these diseases solely by effecting this elimination. Assuming his position to be correct, he sees no reason why salicin should be preferred to salicylic acid or its compounds. These propositions have been almost universally accepted by therapeutists, and at the present day it may be safely said that salicin is not largely used as a substitute for salicylic acid, although as an analgetic and antirrheumatic it still finds some employment.

Therapeutically, salicin has been urged by various writers for a vast multiplicity of ailments. Its first and most important employment was in *acute articular rheumatism*. The results obtained were not encouraging, and even its most ardent advocates have long ago abandoned its administration for this complaint. Its action was so much slower than that of the compounds of salicylic acid that it could not compete with the latter, although the accompanying fever was reduced and the arthritic pain diminished if the use of the drug was continued long enough. In fact, some writers maintain that in a week's time a patient suffering from this disease will feel as well under treatment with salicin as under the more generally approved method of treatment. In *chronic articular rheumatism*, in *gout*, and in those cases of *arthritic pain* which may or may not depend on a uric-acid diathesis, some successful results seem to have been attained by the employment of salicin. In all the *acute inflammatory processes* for which salicylates are given salicin has been tried with varying sequels. In doses of from 20 to 30 grains salicin is said to abort an *acute coryza* and to mitigate the symptoms of *hay fever*. In the same doses, it is said to exert a favourable influence upon *influenza* when taken early in the disease. Salicin has been employed in *pneumonia* as an antipyretic and in *pleurisy* as an analgetic, with results that have not led to its general adoption in the treatment of these conditions. As a local application to the diseased surfaces in *diphtheria* it is useless. In *catarrhal jaundice* salicin is said to abate the symptoms. If this is true, it is probably due to the diuretic action of the drug.

Salicin was early in its career recommended as a specific for the *intermittent fevers*, but it is not to be compared with the cinchona alkaloids in these diseases. As a substitute for quinine it need not be considered. Yet, in cases of *intermittent neuralgia*, when quinine seems to be ineffectual in relieving the pain, salicin sometimes accomplishes this result in doses of from 20 to 40 grains. This is undoubtedly due to its unquestioned analgetic action, for in other *neuralgic* affections, including *lumbago*, salicin exerts at times a marked influence for good. The many other therapeutic recommendations for salicin need not be considered here, since their worthlessness has already consigned them to oblivion.

The dose of salicin for an adult is from 10 to 40 grains. It may be given in wafer, in simple flavoured solution, or in pill form. The fact that no unpleasant symptoms have been recorded after its use in medicinal doses renders it, at least, a safe agent. (Cf. SALICYLIC ACID AND THE SALICYLATES).

SAMUEL M. BRICKNER.

SALICYLACETOL.—See SALACETOL.

SALICYLALDEHYDE - METHYL-PHENYLHYDRAZINE.—See AGATHIN.

SALICYLAMIDE is a derivative of methyl salicylate obtained by the chemical action of concentrated ammonia. The ammonia may be added to the oil of gaultheria, which consists principally of methyl salicylate. When obtained pure, salicylamide appears in thin, colourless, transparent plates. It dissolves readily in 250 parts of water, and is soluble in smaller quantities of alcohol, ether, or chloroform. Its melting point is 292·6° F. Its graphic formula is $C_6H_4\begin{cases} OH \\ CONH_2 \end{cases}$. Salicylamide was first prepared by Limpricht (*Annalen d. Chemie u. Pharmacie*, xcviii).

Administered in toxic doses, salicylamide causes, in lower animals, a paralysis of motor nerves and of the spinal and brain centres. Upon the muscular system, in poisonous doses, it also produces complete loss of function. Although the reflexes are not destroyed, salicylamide evokes a delay in their action and diminishes their force. This action is probably due to a diffusion of the reflex impulse throughout the cord. Nesbitt (*Therap. Gaz.*, October, 1891), who has made a careful study of the drug, believes that poisonous doses diminish spinal conductivity. In this way he accounts for the diminution in peripheral pain which is seen after its administration. Given in mod-

erate doses, salicylamide has no effect upon the heart or pulse, the blood-pressure remaining stable. Upon respiration, the drug seems to have no deleterious effect, even in large doses.

In a solution of 1 to 500, salicylamide seems to have considerable *antiseptic* power. In this strength it prevents the development of bacilli and of micrococci, although Nesbitt (*loc. cit.*) does not mention the species of bacteria experimented with. In very dilute solution it destroys the motile power of the amœba, though movements return if the amœba is washed in clear water. The same effect is noted on the leucocyte. The coagulability of albumin is diminished by the presence of salicylamide.

Therapeutically, salicylamide has not had the career as a substitute for salicylic acid which it was at one time believed it would have. Nesbitt alleged for it that it was safer than salicylic acid for general use, since it contained an amidogen radicle, and Lauder Brunton has stated that synthetic compounds with this radicle as a component part are stimulant in character. This matter, however, has not been further studied. Salicylamide is more easily soluble than salicylic acid, and is tasteless—elements in its favour for medicinal use. Its analgetic influence is said to be marked, and as an antirrheumatic and antipyretic it has had limited employment. The dose varies from 3 to 15 grains, the former for uses in *rheumatic processes*, the latter as a *thermolytic* agent and *antineuralgic*. Nesbitt has reported four cases of *acute amygdalitis* which were apparently cured in twenty-four hours by the use of salicylamide. In *acute articular rheumatism* he also met with successful results. In cases of *visceral pain*, such as *ovarian neuralgia*, and in *neuralgias of peripheral nerves*, the same writer has reported beneficial results from the use of salicylamide. Its value in fevers has not been determined, since no clinical reference is made to the drug as an antipyretic in the literature of the subject.

SAMUEL M. BRICKNER.

SALICYLIC ACID AND THE SALICYLATES.—Salicylic acid, *acidum salicylicum* (U. S. Ph., Br. Ph., Ger. Ph.), is an organic acid existing naturally in combination as salicylate of methyl. Salicylous acid was discovered in 1834 by Pagenstecher, who found it as salicyl aldehyde. Three years later, Piria and Ettling obtained salicylic acid from the product of Pagenstecher's discovery by combining it with oxidizing agents. It was Procter who found that the salicylic acid could be derived from the plant wintergreen (*Gaultheria procumbens*), which contains it in very large quantities as methyl salicylate. The process of its preparation was very expensive, however, until Kolbe, in 1874, showed that salicylic acid could be manufactured cheaply from carbolic acid by means of the elements of carbonic-acid gas. According to this process, the carbolic acid is first mixed with caustic soda in molecular proportions and dried. The resulting acid carbolate of sodium, heated, is saturated with carbonic-acid gas; every pair of molecules of the carbolate then affords one of regenerated carbolic acid, which distils away, and one of normal carbolate of sodium, which is converted into sodium salicylate by absorption of the gas. By the action of hydrochloric acid, the latter furnishes salicylic acid which may be purified by alcohol or ether.

Many plants furnish salicylic acid, but the process of obtaining it naturally is too expensive to render it useful in commerce. It was only after Kolbe's discovery that the drug was taken up by the medical profession. It occurs in small, acicular, white crystals, is odourless, and has a sweetish, acrid, acidulous taste. Its formula is represented by $H_3C_7H_4O_3$. Water at 212° F. dissolves 79·15 parts of the acid. Its solubility is increased by addition of the phosphates, citrates, and acetates of the alkalies and borax. The fixed oils, ether, and chloroform also dissolve salicylic acid. Glycerin, on being warmed, dissolves 4 grains of the acid to a drachm. Pure salicylic acid should be free from the odour of phenol. When salicylic acid is heated on platinum foil it should leave no ash, a proof of its freedom from mineral contamination.

The closeness to cinchonism of the symptoms induced by salicylic acid in doses sufficient to exert any influence has led to some therapeutic errors. Its first manifestations are fulness of the head, with tinnitus aurium, buzzing, humming, whistling, or knocking sensations in the ears. Larger doses induce headache, with a sense of distress, and visual disturbances amounting even to temporary blindness. The hearing may simply be dulled, or a partial deafness may be evoked. Mental dulness and apathy supervene, and the gait becomes uncertain. Delirium may appear and respiratory disturbances have been reported, consisting of a deepening of the respiratory movements and an increase in their rapidity. Sometimes extreme dyspnœa is added. Sweating is evoked and becomes very free. The heart grows tumultuous in its action and may be feeble in its beat. The temperature may remain or may sink below normal. Toxic doses may produce nephritis with vesical irritation. If the kidneys are sound, salicylic acid, even in poisonous doses, may not affect them; but albumin and even blood may pass off in the urine.

Salicylic acid is an irritant to the mucous membranes, producing a feeling of rawness. It is frequently the cause of nausea and vomiting when given uncombined, and catharsis or diarrhœa may occur. Urticarial and exanthem-like eruptions have appeared upon the skin after even small doses of the drug.

The action of salicylic acid and its sodium salt are practically identical, and will be considered together. The symptoms thus far described are attributable to either drug. When it is given in poisonous doses, all the manifestations of the larger doses are exaggerated. Delirium may appear, either of maniacal or melancholic type. Hallucinations, often in the shape of visions of animals, may come on, or there may be a tendency to drowsiness. Death may occur suddenly or accompanied by convulsions and extreme dyspnœa.

Salicylic acid in moderate doses does not materially affect the blood-pressure, but large doses cause a depression, not only in the pressure but in the cardiac beat. The drug has a cumulative action, and it is possible that the heart weakness sometimes observed after a long-continued use of the salicylates may be due to this fact. Upon the peripheral nervous system the action is not definitely determined, but upon the central nervous organism its influence is above detailed. Upon the respiration the effect of moderate doses is an acceleration and deepening. When toxic doses have been administered, death ensues either with intense asphyxia or by sudden depression of the respiratory centre.

Upon *fever*, salicylic acid has a decided *antipyretic* action. Especially in the fever of *acute articular rheumatism* does it exert almost a specific action. The fall is accompanied by profuse sweating, which may appear within a short time after the ingestion of the drug. This sweating is apt to be very exhausting, and it is quite probable that the lessening of the force of the heart's beat may be dependent upon the fall of temperature. The temperature reaches its minimum in about six hours —sometimes in less time—and, if it rises, will return to a level not so high as it had reached before, quite rapidly.

Pulmonary hæmorrhage and epistaxis have been reported to follow the use of salicylic acid. Although the *oxytocic* power of the salicylates is in doubt, there is no question that they have caused abortion and provoked uterine hæmorrhage. Whether or not they increase the menstrual flow has not been determined.

Absorption of the salicylates takes place very rapidly from the intestines, where it is probable that salicylic acid is converted into a salt. Although it escapes chiefly through the kidneys, salicylic acid does not appear as such in the urine, but in the form of salicylates and salicyluric acid. The green colour of the urine after the use of salicylic acid or its derivatives is due to the presence of indican or of pyrocatechin, the latter possibly derived from the acid. The drug is absorbed through the skin and can be detected in the form of one of its compounds within a few minutes after inunction. It has been found in the saliva, in the serum of blisters, and in the sweat, but never as salicylic acid. The urine may be diminished in quantity, though it is usually increased. Moderate doses do not affect a sound kidney or bladder, but, as previously pointed out, hæmaturia or albuminuria may follow the use of salicylic acid. Reporters differ as to the elimination of urea and uric acid. Germain Sée observed no change in the nitrogenous elements in the urine after the use of the drug, either in disease or in health. Other observers have found a great increase in the solid matter excreted in the urine. According to Haig, the curative virtues of salicylic acid and its compounds in acute articular rheumatism depend upon the amount of uric acid they are capable of eliminating from the organism; as a matter of fact, the manner in which these agents are of benefit is ill understood even at the present day. The question of uric-acid secretion being enhanced by salicylic acid is still *sub judice*.

Therapeutically, salicylic acid and its derivatives are useful as *antipyretics*, *analgetics*, and *antiseptics*. As an antipyretic, the mode of action of the salicylates is not determined, but it is true that they have a pronounced thermolytic power. They are very decided in their effects, and the decrease in temperature is quite lasting. A fall from 103° to 98° F. in rheumatic fever is not unusual. There are many cases of hyperpyrexia in rheumatic conditions which the salicyl compounds fail to relieve, however, and, indeed, an instance is recorded in which sodium salicylate sent a temperature of 101° to 107° F., although it is altogether likely that this was a coincidence. The discovery of other and more valuable antipyretics, including the cold bath, has led to the abandonment of salicylic acid as an antipyretic in almost all diseases except those of rheumatic origin or affiliation.

As *analgetics*, the salicyl compounds have some just reputation. In *sciatica* and *neuralgias of various types* they sometimes produce decidedly beneficial effects. The pains of *locomotor ataxia* and of *peripheral neuritis* may sometimes be controlled by the use of salicylic acid or its sodium salt. The discomforts of *muscular rheumatism* are sometimes relieved by moderate doses. *Gonorrhœal rheumatism* does not seem to be influenced by the agents under consideration, although they are usually given, and although some observers have reported beneficial results.

The introduction of salicylic acid to the medical profession was due to the discovery of its *antiseptic* properties. A small percentage (from 0·3 to 0·4 per cent.) is sufficiently strong to kill bacteria in culture. One part to 2,000 will prevent putrefaction in urine, and solutions of organic materials can be indefinitely maintained intact by the addition of salicylic acid or sodium salicylate. These agents, in small percentage, are able to check amylaceous and proteid digestion. Salicylic acid was used for a long time for the preservation of food stuffs, beers, and wines, but in 1881 its use was forbidden by the French Government after it was proved that its continued and prolonged ingestion might be dangerous or serious. This antiseptic power has been employed in the preservation of inorganic solutions as well. In surgery, salicylic acid has never had much employment. It causes steel instruments to corrode, and is not agreeable for use in and about wounds. *Salicylic-acid cotton*, containing 3 and 10 per cent. of the acid, is manufactured for dressings to apply next to a wound.

When it is desired to use salicylic acid and not one of its salts, it may be given as such or in the form of oil of gaultheria (see GAULTHERIA). Eminent authorities agree that in *acute articular rheumatism* there is no drug the empirical employment of which has met with such universal favour. It certainly reduces the pulse-rate and fever, although the disease itself may not be eradicated. (For a brief discussion of its use, see under *Sodium*

salicylate, in this article). In *chronic articular rheumatism* salicylic acid seems to be useless. In the treatment of *rheumatic irido-chorioiditis* and *sclerotitis* it is valuable in doses of 15 grains four times daily. In *gout* it frequently arrests paroxysms of attacks and prevents relapses, at the same time favouring the absorption of deposits of tophi. There is no evidence to prove that, in the treatment of *intermittent fevers* or of the *acute infectious diseases*, it is of the least value. Success has been alleged for the drug in *relapsing fever*, but this statement rests upon slender testimony. In *acute inflammatory processes* it may be used as an antipyretic, but it is very doubtful if it arrests their course. Of very meagre value is it in the treatment of *diphtheria*. It is probably little better or little worse than other drugs in *aphthæ*, or *thrush*. In *dysentery*, enemata of salicylic acid in a strength of 1 to 300 are said to lessen the frequency of the stools and to destroy their fœtor. In *gastric catarrh* and *intestinal flatulence*, salicylic acid may decrease the formation of gas. The drug has been employed for the expulsion of *Tænia solium*, in doses of 12 grains, following the administration of castor oil upon a fasting stomach.

The respiratory tract has had its share of experiments by the use of salicylic acid. The drug has been given by inhalation to destroy the odour of *fœtid bronchitis* and *gangrene of the lung;* and in *phthisis* it has been employed to reduce the fever. On none of these ailments does it exert any curative influence. *Acute coryza* and *hay-fever* are alleged to have their symptoms mitigated by the use of the drug. Small doses are said to have cured cases of *diabetes*, but this may well be doubted. The pains of *herpes zoster* and of swollen joints in *purpura hæmorrhagica* are said to be relieved by the use of salicylic acid.

Locally, this agent has a host of applications. It has been employed with varying results in *hyperidrosis* of the feet and hands, in *psoriasis*, and for the removal of *corns* and *warts*. For this last purpose the plaster-mull of Unna is really valuable. This consists of a mixture of from 30 to 50 parts of salicylic acid and from 5 to 10 parts of creosote spread upon gutta-percha. For the destruction of *parasites*, salicylic acid is of value in a strength of 1 to 500. In *eczema* and *intertrigo* excellent results are attained with a 4-per-cent. ointment. *Chronic urticaria* has been cured by the ingestion of 20 grains thrice daily. As a *styptic* in *slight hæmorrhages*, in *erosions of the cervix uteri*, in *carcinoma of the uterus*, and in *metrorrhagia* not dependent on some gross lesion, tampons moistened with a solution of salicylic acid are valuable. A *salicylate of iron* has been vaunted as a styptic agent, but is rarely used. A nasal douche of salicylic acid of a strength of 1 to 1,000 is palliative in *chronic ozæna*. Salicylic acid has some virtue as a *deodorizer*, but in this respect it is an inferior agent.

The *dose* of salicylic acid varies with the purpose for which it is given. A drachm in twenty-four hours, in divided doses, in acute articular rheumatism, represents the average administration. It is frequently given in larger doses. It may be administered in wafers, in simple solution, or in some flavouring vehicle.

[The official salicylic-acid ointment, *unguentum acidi salicylici* (Br. Ph.), contains 1 part of the acid, 18 parts of soft paraffin, and 9 parts of hard paraffin.

A form of *chronic salicylic-acid poisoning* manifested by a congested, swollen, and œdematous state of the mucous membrane of the air-passages sometimes occurs among workmen employed in manufactories in which they are exposed to inhalation of the acid, especially, as it appears, of the amorphous form. Dr. Ludwig Ebstein (*Wiener klin. Wochenschrift*, March 12, 1896; *N. Y. Med. Jour.*, March 28, 1896) relates the case of a man, sixty years old, a maker of preserves, who for two years had suffered with a tormenting cough, by day as well as by night, accompanied by difficult expectoration of a very thick, gray mucus. In April, 1895, his condition had become so aggravated that there was often dyspnœa in the daytime, the cough had increased in intensity, and every night he was suddenly awakened with a feeling of suffocation, so that he had to resort to the inhalation of steam, whereby he was enabled to cough up with difficulty a scanty, thick secretion, and the dyspnœa was rendered more tolerable. Up to the middle of September, when Dr. Ebstein first saw him, the symptoms had kept on increasing, and a sense of dryness had been added to them. The whole nasal mucous membrane was then of a dusky-red colour, with a very scanty secretion, and the nasopharynx showed the same appearances. The pillars of the fauces appeared as inflamed swellings which were thrown into horizontal folds when swallowing movements were executed. The upper part of the larynx showed nothing abnormal beyond moderate inflammatory redness and swelling, but the vocal cords showed a striking change in the neighbourhood of the vocal processes—on the upper surface of each cord, projecting beyond its border, there was an œdematous, tumour-like swelling, and the two cords "smacked" perceptibly on phonation. The trachea, which was readily visible to a considerable depth, showed a uniform swelling of the mucous membrane, which was of a deep-red hue and covered here and there with thick, gray secretion. The swelling was so great as to produce a notable stenosis, reducing the calibre to the size of one's little finger. There was manifest stridor with each inspiratory and expiratory movement, and both these movements were prolonged. There were dry, piping murmurs in all parts of the chest. The diagnosis arrived at was that of bronchitis sicca with slight emphysema. The swelling of the tracheal mucous membrane was somewhat reduced by five days' inhalations of a spray of a weak solution of sulphate of zinc, but expectorants had no effect on the thick bronchial secretion. Inhalations of atomized solutions of sodium bicarbonate, sodium chloride, etc., served only to increase the sensation of dryness. Finally, *iodide of potassium* was prescribed, as recommended by Cantani, and proved to be most efficacious;

the secretion became thinner and the swelling of the tracheal mucous membrane grew manifestly less. At the end of four weeks the man was entirely free from his troubles. But in five days after his returning to his work he had a relapse, and then for the first time it came out that he was in the habit of handling salicylic acid in his occupation. A resumption of the treatment accomplished a cure again in the course of three weeks. Then the man gave up the use of salicylic acid, and he had no further return of the trouble. Although he had employed the acid for years, it is noteworthy, says Dr. Ebstein, that the pronounced aggravation of his symptoms had followed close upon his giving up the use of the crystalline acid and using the amorphous form instead.

Dr. H. Radcliffe Crocker (*Lancet*, June 8, 1895; *Internat. Med. Magazine*, August, 1895) says that he first prescribed the salicylates in a case of *psoriasis* accompanied by symptoms of amygdalitis, and the improvement in the appearance of the patches from week to week was very remarkable. Since then he has given the salicylates an extensive trial, with the results in many instances equally striking and conclusive, especially in cases of *psoriasis guttata* of extensive and recent development, the very form unsuited for the employment of either thyreoid extract or arsenic. Under the influence of the drug he has observed a diminution of the hyperæmia, the scales being no longer formed abundantly, while the old crusts became easily detached, leaving a pale-red surface which became smoother from week to week. Should the drug produce any gastro-intestinal irritation, he says, an aggravation of the psoriasis may result, requiring the administration of an alkaline sedative for a few days, when the salicylates may be given again in smaller doses. He reports also much success in the salicylate treatment of the various forms of *erythema multiforme*, and also in *erythema nodosum*, and mentions one case of *lupus erythematosus* in which striking improvement followed its employment. He sums up as follows: Salicylate of sodium and probably salicin and its derivatives are of great value in psoriasis, especially during the period of active development, and in hyperæmic cases which are unsuitable, as a rule, for either arsenic or thyreoid extract. They are useful in all forms of the disease, except, perhaps, in old chronic patches, but their administration must be temporarily stopped if they give rise to any dyspeptic symptoms.

In the *Therapeutic Gazette* for April 15, 1896, Dr. J. Abbott Cantrell reports upon about ten years' experience of his in the use of salicylic acid in skin diseases at the Philadelphia Polyclinic and College for Graduates in Medicine. In the topical employment of the drug he uses ointments of a strength of from 2 to 15 per cent., made with either vaseline or lanolin, sometimes together with zinc oxide; or washes of from 2- to 20-per-cent. solutions in water or in an emulsion with a small amount of mucilage of acacia; or plasters ranging in strength from 10 to 25 per cent.

In *erythematous eczema* the treatment gave excellent results when the disease was confined to a small single area, especially in cases that were rather subacute; but where the eruption was more or less general or the inflammation was high, it was not thought advisable to resort to it. In *papular eczema* the drug was used only where there had been a coalescence of the lesions, such as is often seen on the legs, and then only when the condition was more or less chronic. If the inflammation was acute or the lesions were rather scattered in irregular patches, the treatment did not have the same good effect. In *vesicular* and *pustular eczema*, weak ointments produced excellent results. Salicylic acid, however, gave much better results in *eczema rubrum* and *squamous eczema*, also in eczema with considerable fissuring. The good results were most noticeable in cases of long standing, especially those in which there was much infiltration and thickening.

Desquamative eruptions yielded rapidly to the use of salicylic acid in some instances. *Pityriasis capitis* in which desquamation was the marked symptom behaved exceedingly well under the use of a solution in water. *Ichthyosis* of the mild varieties was benefited by ointments. In *psoriasis* possibly the best effects were seen, but only so far as the removal of the scales was concerned, as the entire curative results depended upon the internal administration of suitable remedies. *Dermatitis exfoliativa* as a distinct disease or where it followed upon a psoriasis was much benefited by the use of salicylic acid in the ointment form. *Pityriasis rubra* improved under the use of mild ointments.

Ringworm of the body (*tinea circinata*) was cured with a mild ointment, but *ringworm of the beard* (*sycosis*) and *of the scalp* (*tinea tonsurans*) did not yield so quickly to the action of the drug.

Favus yielded to about the same extent as to other remedies, but if any good did result from the use of salicylic acid it was only from the stronger ointments.

Pigmentary affections were not affected so quickly as by other remedies. *Chloasma* yielded only to a slight extent, but *lentigo* was cured in the majority of instances when treated with strong applications.

Affections of the sweat glands, both *hyperidrosis* and *dysidrosis* with occlusion of the follicular openings and the formation of vesicles at these orifices, were benefited greatly by the application of either an ointment or a solution of salicylic acid. It acted as a stimulant to the glandular structures, promoted a proper secretion, and prevented the formation of lesions at the follicular openings, as well as removing the summit from the vesicular lesions that had formed and allowing the blocked follicles to be emptied of their contents.

Inflammatory conditions of the sebaceous glands improved under the application of salicylic acid, both in ointment and in solution; *papular acne* was benefited greatly, especially where induration was a marked feature, and *pustular acne* was subdued by its judicious use. *Seborrhœa* occurring either on the scalp,

on the chest, or around the nasal orifices, was cured by the use of an ointment.

Corns were softened so that they were easily removed with the curette or with the finger alone. *Warts* also shared this softening process, and after removal by the curette did not return.

Epithelioma, after the removal of the crusts, was removed by the action of salicylic acid in the stronger ointments, but where these new growths had progressed for some time the drug did not have the same effect.

In *impetigo contagiosa* the remedy acted favourably. *Rhus poisoning* was greatly and quickly relieved, while the *eczema* constantly seen after this condition was entirely removed.

Both *syphilitic* and *non-syphilitic ulcerations* were benefited by the action of this drug, and in a short time it could be seen that the bases of the ulcers were healing. During the treatment of the syphilitic ulcers internal medication and other proper measures were associated with the use of the acid.

Remarkably good results followed the employment of the acid also in *lupus erythematosus* of the face, *lichen æstivus* occurring upon the trunk, and *molluscum contagiosum* after the removal of the summits of the little grayish-white bodies. In *urticaria* there was much relief from *itching*, but internal and other treatment was adopted at the same time. *Nail deformities*, especially of the hypertrophic varieties, were improved, and particularly where the condition was caused by an eczematous process.

Dr. Fafiourse (*Province méd.*, May 18, 1895; *N. Y. Med. Jour.*, June 15, 1895) reports the successful employment of salicylic acid in seven cases of *cancer of the uterus*. He used a 5-per-cent. solution of the acid in alcohol in the following manner: The patients received previously vaginal antiseptic injections from two to three times a day, one of these injections always preceding those of salicylic acid. From one to four cubic centimetres of the solution were injected into the vaginal portion of the neck of the uterus in five or six places in the affected region. The vaginal portion was then dried with tampons of cotton and dusted with iodoform, and the vagina was packed with two or three tampons of cotton saturated with a mixture of glycerin and iodoform. The patients were then put to bed and ordered to remain there during the day without moving; in the evening (or on the following morning if there was abundant hæmorrhage) the tampons were withdrawn and a vaginal injection was given.

The first injections were usually followed by a rather profuse hæmorrhage, but the more frequent the injections the less abundant the hæmorrhage. In the majority of cases the injections are painful, but the pain disappears very rapidly, and there are no secondary unfavourable symptoms of any kind. The injections are repeated more or less often, according to the gravity of the case and to the intensity of the patient's suffering.

Dr. Fafiousse says that the results of these injections are the almost complete cessation of metrorrhagia, disappearance of the leucorrhœa, diminution of the pain, amelioration of the general condition, and arrest of the progress of the disease. It will be seen then, he adds, that the injections of salicylic acid are superior to all other means of treatment proposed for "inoperable" cancer.]

Borosalicylic acid, *acidum boro-salicylicum*, is a white, crystalline powder, quite soluble, of a very bitter taste, and of decidedly *antiseptic* properties.

Ammonium salicylate is sometimes used as a substitute for salicylic acid. It has a sweet taste, and is readily soluble.

Antipyrine salicylate.—See SALIPYRINE.

Beta-naphthol salicylate (*betol-naphthalol*) occurs in white shining crystals, is odourless and tasteless, and is soluble in hot alcohol, though not in water. It is occasionally used instead of salol, as it yields naphthol instead of phenol to the intestines by its splitting. It does not give up its component parts readily, however, and contains less salicylic acid than salol. It has been used in *acute articular rheumatism* and in *cystitis with ammoniacal fermentation*. It may be used in the form of suppositories or bougies, as butter of cacao dissolves a quarter of its weight of the salt.

Bismuth salicylate is a soft, white powder, soluble only in acids. It is a *local antiseptic*, and is used in *chronic intestinal catarrh* and in *cholera infantum*. The dose for an adult is from 10 to 20 grains every eight hours. It prevents putrefaction in the stomach, and may be given in combination with strychnine when gastric digestion is impaired by fermentative processes. Wagner (*Am. Jour. of Pharm.*, May, 1886) maintained that this salt was a cardiac stimulant.

Cinchonidine salicylate may be used in the absence of quinine as an *antiperiodic*. It is inferior to the other preparations of the alkaloids of cinchona. In *chronic* and *subacute articular rheumatism* it has been used in doses of from 15 to 20 grains daily.

Calcium salicylate appears in the form of a white, crystalline powder, tasteless, odourless and freely soluble in dilute acetic and mineral acids, sparingly soluble in water. It has been employed in the *diarrhœas of children*, in doses of from 7 to 24 grains. Locally, in solution, its beneficial use in *chancres* and *syphilitic ulcers* has been recorded.

Guaiacol salicylate is a chemical analogue of salol. It is a white crystalline powder and, like most of the salicylates, is odourless and tasteless. The dose, for purposes similar to those for which salol is employed, is from 15 to 150 grains daily.

Lithium salicylate is a white, deliquescent powder, of a sweetish taste. It is very soluble in water and in alcohol. The supposed advantage of the lithium base probably proceeds from the belief that it will act as an eliminative agent toward uric acid. It is useful as a substitute for the sodium salt in *acute articular rheumatism* and in *pyrexia*. Its dose is from 6 to 15 grains, to be repeated until physiological effects are produced.

Mercuric salicylate is a white, amorphous powder, rarely used.

[**Methyl salicylate** is the chief constituent of oil of wintergreen (see GAULTHERIA).

Naphthol salicylate.—See BETOL.]

Phenyl salicylate is salol (*q. v.*).

Physostigmine salicylate, or *eserine salicylate*, appears in colourless, glossy crystals or needles, and has a slightly acid reaction. It is very sparingly soluble in water, but may be employed hypodermically in doses of from $\frac{1}{10}$ to $\frac{1}{12}$ of a grain. It is occasionally used in *dysentery* and *diarrhœas*. In a solution of alcohol and water it may be used to cause meiosis by instillation into the eyes.

Potassium salicylate has been used as a substitute for the sodium salt in rheumatism, but is inferior to it in action.

Sodium diiodosalicylate, in doses of from 20 to 40 grains, has been used as an *antipyretic* and *analgetic*. It has a sedative influence upon a *tumultuous, irregular heart*. Locally, it has been used as an *antiseptic* in *parasitic diseases of the skin*.

Sodium dithiosalicylate is a more powerful antiseptic than the salicylate. It has been given in *acute articular rheumatism*, and is said not to produce the disagreeable aural symptoms caused by the salt more commonly used. The dose is from 3 to 30 grains, given morning and evening.

Sodium salicylate, *sodii salicylas* (U. S. Ph., Br. Ph.), *natrium salicylicum* (Ger. Ph.), is the most widely used of the salts of salicylic acid. It is obtained by the action of salicylic acid on the carbonate of sodium or on sodium hydrate. It is an amorphous, inodorous powder, with a sweetish, saline taste. It remains permanent in the air and is very easily soluble in water and in glycerin. An aqueous solution of the salt reddens blue litmus paper. It is incompatible with antipyrine (see SALIPYRINE).

The ready solubility of sodium salicylate makes it preferable for therapeutic use to the other salts of salicylic acid. It is not severely irritating to mucous membranes, although it frequently causes nausea and vomiting in medicinal doses. A drachm taken daily for six weeks has produced pronounced mental symptoms of an unfavourable character, which, however, disappeared after the drug had been withdrawn. Some persons are particularly susceptible to its influence, and the manifestation of disagreeable phenomena must be a signal for the suspension of its employment. In general, its physiological action, absorption, and elimination are similar to those of salicylic acid. Cutaneous eruptions, collapse, and delirium have appeared after an overdose.

Its influence on the course of *acute articular rheumatism* is similar to that of salicylic acid. Because of its more agreeable qualities, it is largely used in preference to its acid. Although sodium salicylate does not show in every case remarkably good results in the abatement of fever and reduction of pain, the great majority of cases yield to its influence. So universal is this beneficent showing that failure of the drug is apt to impugn the diagnosis. Most, but not all, arthritic pains do not yield to the drug, and this is particularly true of the gonorrhœal and pyæmic joint affections, as well as of other uniarticular arthritic lesions. In acute articular rheumatism, however, sodium salicylate should be first tried, and its influence observed. Hood (*Lancet*, February 18, 1888) thus characterizes the influence of the salt upon acute rheumatism: It relieves pain and reduces fever, but renders the patient subject to relapses; it does not affect the frequency of cardiac complications [on this point authorities differ]; it does not prevent hyperpyrexia; it does not modify the mortality rate. It is most efficient, he concludes, in combination with an alkali treatment. This summary probably represents the opinion of those most qualified to judge in the matter; and, since salicylic acid or its sodium salt is in daily use the world over, there can be no question as to its great value and almost specific influence in acute articular rheumatism.

The dose of sodium salicylate in this affection varies according to different writers. It may be given in amounts of from 15 grains every four hours to single large doses of a drachm. As a general rule, not more than 2 or 2½ drachms should be given in twenty-four hours. When it is given in divided doses, the doses must "overlap" each other, as it were, in order that the continuous effect of the drug may be secured. As it takes from four to six hours for sodium salicylate to influence the organism, the dose should be repeated within this time. It may be given in simple solution in peppermint water or, to disguise its disagreeable taste, in some syrup or licorice preparation. Usually its benign influence is manifested in from fifteen to thirty hours.

Sodium salicylate has been widely used in *acute follicular amygdalitis* supposed to be rheumatic in origin, in the same doses as in rheumatism. In *facial neuralgia* and *dysmenorrhœa* it relieves pain. In the treatment of *migraine* and *pertussis* it is said to mitigate the symptoms; but in these ailments its nauseating tendency should render its use cautious. In *rheumatic iritis*, as well as in *iritides of gonorrhœal* and other origin, and in *acute glaucoma*, it is analgetic and hastens recovery. It has been widely recommended in *dry pleurisy* and *pleurisy with effusion*, and in *neuralgic affections of peripheral nerves*. Robinson (*Am. Jour. of the Med. Sci.*, November, 1895) recommends the sodium salt or salicylic acid in cases of *cough dependent upon enlargement of the lingual tonsil*. As an antacid and antiseptic agent, sodium salicylate has been praised in the treatment of *cholera infantum* and other *diarrhœas* the origin of which is infection. The use of the drug is contra-indicated in the presence of albuminuria, because of its irritant action on the kidneys. The salicylate of sodium has been used in almost all the *acute infectious diseases* with results that are not encouraging. In *exophthalmic goître* Chilret (*Rev. générale d'ophthalmol.*, 1895, No. 1) professed to have accomplished cures in four cases by the administration of 75 grains of sodium salicylate daily.

Strontium salicylate has been used by Wood (*Univ. Med. Mag.*, vii, 4) in doses of from 15 to 20 grains daily as an *antizymotic* and *antiseptic* in *flatulent dyspepsia* and *fermentative changes in the intestines*, with good results. In small doses it acts as a *bitter*. The disagreeable effects of the other salicylates seem not to be evoked by ordinary doses. In *subacute* and *muscular rheumatism* beneficial effects have been obtained. The drug may be given in solution or in capsules.

SAMUEL M. BRICKNER.

SALICYLIDENE PARAPHENETIDINE.—See MALAKIN.

SALIGENIN, or *salicyl alcohol*, $C_7H_8O_2$, has been used by Dr. L. Lederer, of Munich (*Münch. med. Woch.*, 1895, No. 7; *Dtsch. Med.-Ztg.*, March 12, 1896), who says that salicin consists of saligenin and glucose, into which it splits up in the system, and that saligenin is the active principle. Saligenin has been tested in cases of *acute rheumatism*, and has been found a very efficient remedy. It is speedy and sure in its action, and thus far it has been observed to be free from unpleasant effects. Dr. Lederer gives the histories of eight cases of *acute articular inflammation* in which saligenin was used, and says that in such cases, no matter whether they are of a rheumatic or of a gouty nature, the inflammation is promptly brought to an end. The unpleasant effects of salicylic acid, such as the sickish-sweet taste, ringing in the ears, disturbed digestion, blueness of the lips, etc., are not experienced, and the sweating is hardly noteworthy. According to the severity of the case, Dr. Lederer orders from 7 to 15 grains of saligenin, in the form of powder, to be taken every hour or every two hours. As saligenin dissolves readily in alkaline juices, Dr. Lederer thinks it would prove highly serviceable in such other diseases as *typhoid fever*, *cholera*, *influenza*, *malarial fevers*, *dysentery*, etc., in which salicin has been employed.

SALINAPHTHOL.—See BETOL.

SALINES, in the therapeutic sense, are remedies which have the nature of salts, especially salts of the alkalies, and which are used either as *cathartics* or as *diuretics*. The more exact terms saline cathartic and saline diuretic are to be preferred to the unqualified name saline, though its use or that of its popular synonym, "salts," ordinarily with the cathartic significance, is frequent. The saline cathartics in common use are magnesium sulphate, sodium sulphate, magnesium citrate, sodium phosphate, and potassium and sodium tartrate, with their modifications, solution of magnesium citrate and seidlitz powder. The activity of the saline cathartics depends upon their power to increase intestinal secretion, for upon peristalsis they probably exert no greater influence than would be explained by the presence of the fluids thus poured out in the intestines. Experiment has demonstrated that the strength of the solution of a saline cathartic as it exists in the intestine within two hours after the administration of the salt is 5 or 6 per cent. If the salt has been given in greater dilution than this, water has been absorbed from it until this strength has been reached; if in greater concentration, the tissues have yielded their fluids to dilute it to the necessary degree. The inference is therefore clear that saline cathartics, to produce serous depletion, should be given in concentration, while if promptness of action is sought for, a solution of about 5 per cent. strength will be more efficacious. If for any reason purgation does not follow the use of a saline cathartic, absorption of the remedy will take place, with the result that a considerable diuresis will often be produced by it. The evacuations caused by saline cathartics are invariably watery.

The saline cathartics are used where large fluid evacuations are required. In *acute inflammations* they are antiphlogistic; in *congestive* and *dropsical conditions* they are active as hydragogues; in *abdominal inflammations*, such as *appendicitis*, they are of great value, not only because of antiphlogosis but because of the intestinal depletion they cause with little increase in peristaltic action. Saline cathartics are often excellent hæmostatics, especially in *abdominal hæmorrhage*, for they lower blood-pressure in the affected area and thus produce relief. In *hæmorrhages due to hepatic obstruction* they are particularly beneficial, in a manner similar to that in which they relieve the *ascites of hepatic cirrhosis*—that is, by portal depletion. In the plethoric, the daily administration of salines is highly to be recommended, especially if *constipation* is present, as is so frequently the case. In acid conditions, such as *rheumatism* and *gout*, the salines are of much service, both by their power to aid elimination and probably by an antacid effect as well.

Saline diuretics include a number of the alkaline salts, and, as has already been said, the saline cathartics will often act as diuretics if for any reason catharsis does not follow their use. The converse of this is sometimes true also, and saline diuretics, such as potassium acetate, may cause catharsis in some subjects without producing diuresis. The most active of the saline diuretics are the salts of lithium and potassium, though some of the sodium salts are not deficient in this respect. Many of the saline diuretics are antacid by virtue of their chemical nature, and so act to alkalinize the urine and to exert the constitutional power of antacids. Of the saline diuretics, the most important are potassium acetate, potassium citrate, potassium tartrate, potassium bitartrate, lithium carbonate, lithium citrate, solution of ammonium acetate, and sodium acetate.

HENRY A. GRIFFIN.

SALIPYRINE is a combination of salicylic acid and antipyrine, intended to obviate the deliquescence which takes place on the mixture of antipyrine and any of the salts of salicylic acid. It contains 42·3 parts of salicylic acid and 57·7 parts of antipyrine. It is a white, coarsely crystalline powder without odour. Its formula is given as $C_{11}H_{12}N_2O.C_7H_6O_3$. The powder is not hygroscopic. It dissolves very sparingly in water, more freely in alcohol.

From an alcoholic solution, salipyrine separates in hexagonal crystals.

Taken into the mouth as such, salipyrine imparts a rough sensation to the tongue. Like all the synthetic antipyretics, it produces, in moderate doses, a copious perspiration during defervescence. But little discomfort attends this exudation, exhaustion not being so pronounced as in the thermolysis called forth by antipyrine alone. The minimum temperature after a dose of salipyrine is reached in from three to four hours, when it slowly rises again, reaching the original mark in from four to five hours. Chirone maintains that, while the central temperature is reduced by the drug, the peripheral temperature rises. As is the case under the action of quinine and that of most of the antipyretics, the pulse falls with the temperature, but with apparently no diminution in the force of the cardiac beat. In febrile diseases with a continuously high temperature, the action of salipyrine as an antipyretic seems less efficient than in the intermittent types of fever. Normal temperature is not affected by the drug.

The influence of salipyrine upon the nervous system has not yet been carefully worked out. Upon the lower animals it produces an increase in reflex excitability which is temporary. Even in large doses it seems to have no deleterious effect upon the central nervous system. Upon the heart the depressing influence of antipyrine appears to be lost. Although salipyrine is not a cardiac stimulant, it does not induce weakness of the cardiac beat. Its effect upon the pulse has not been determined, but, although it decreases the number of beats, there is no record of weakness produced by it. Salipyrine is said to produce a *hypnotic* effect if taken in large doses, and it has been alleged for it that it is *calming* in its influence upon an *excited and irritable nervous system*. An *aphrodisiac* effect is noted in some persons after taking the drug.

Experimenters and observers differ in their statements as to the influence of the drug upon the gastric mucous membrane. Although antipyrine and salicylic acid may either of them provoke nausea and vomiting, some therapeutists maintain that salipyrine does not evoke this action. Others, and among them the writer, have seen nausea follow the use of the drug, but actual vomiting has not occurred. In one case the nausea continued for over eight hours.

Toxic effects of salipyrine have not been recorded, although some large doses have been taken accidentally. In one instance 2½ drachms were administered within four hours and a half without any injurious sequelæ being observed. The drug has been too little studied for a complete account of its physiological action to be given; but, so far as it has been investigated, it appears to be safe in ordinary doses.

The main uses of salipyrine may be classified under two heads: *antipyretic* and *analgetic*. As a thermolytic agent, it is, as stated above, of more use in fevers of an intermittent type than in those with a continuously high temperature. In *typhoid fever* it will reduce the temperature, but it requires a dose larger than the usual antipyretic one to accomplish this result, and the effect is not so prolonged or so deep as that of other antipyretic agents. In *intermittent fevers* of any kind, however, it is safe to give salipyrine for thermolytic purposes, as it does not depress the heart's action and reduces an abnormally high temperature from two to three degrees F. The larger the dose, the more pronounced is the thermolysis, and the longer does its action continue. The temperature slowly rises after the minimum has been reached, reaching the same degree as that at which the drug was given in from three to five hours. Salipyrine has been recommended as an antipyretic in those cases particularly in which collapse or cardiac depression is feared. Naturally, in those instances in which a febrile movement is dependent upon malarial infection, salipyrine is inferior to quinine; and in the infectious diseases and the exanthemata, when an antipyretic may or may not be indicated, the continuous high fever is a contra-indication to its use. It is doubtful if it will ever be able to supplant some of the more important antipyretics or the cold bath, safe as its action on the heart is alleged to be.

The mode of action of salipyrine as an antipyretic has not been established; but it is probably central, either by direct action upon the heat centre or by influencing the vaso-motor centre.

Salipyrine has been recommended in the treatment of *acute* and *chronic articular rheumatism*. In the former, not only does the agent act as an antipyretic, but it is alleged for it that it has a specific action upon the inflamed joints. Active movements of the joints, it is said, are possible without pain, and passive motions can be performed with less distress to the patient. Sometimes 2 drachms, given in divided doses, seem to alleviate all symptoms, while in other cases the administration of the drug has to be continued for a varying period. In the chronic form of articular rheumatism, salipyrine may be given instead of the salicylate of sodium; but here the drug must be administered for several days before improvement is manifested, and Hennig (*Deutsche med. Woch.*, 1891, Nos. 35 *et seq.*) has been obliged to administer it for months in some cases in order to maintain a standard of well-being. The arthritic pains of *gout* are said to be diminished by the use of salipyrine.

In the treatment of *neuralgias* of various kinds salipyrine has been tried, like most other drugs which have the least analgetic action. Its action in this form of ailment really seems to be what is alleged for it—*antineuralgic*. Unquestionably this influence is due to the salicylic acid contained in it, although in part to the antipyrine, closely united chemically as the two substances are. It is most efficacious in *facial neuralgia* of the *trigeminal* type, although good reports of its use have been recorded in neuralgic affections of the sacral and lumbar plexuses. In *myalgia* it is also recommended by Hennig, who says that muscular movements and the pain were favourably impressed. Salipyrine has been used in *cepha-*

lalgias; but in cases of migraine it is probably not wise to administer it, on account of the nausea it may produce.

Salipyrine is vaunted as a particularly efficient drug in *influenza*, not only cutting short incipient forms, but acting favourably upon the disease when it has already been established. Writers upon this therapeutic use of the drug allege that the pains incident to the affection are lessened, particularly the muscular pains and the headache. Sleep is procured by the administration of salipyrine, and the patient's general well-being is furthered. Upon the bronchial disturbances which are usually part of the disease this medicament has no favourable action.

In cases of *metrorrhagia* and *menorrhagia* salipyrine has been praised as being preferable to ergot (Orthmann, *Deutsche klin. Woch.*, 1895, No. 7). It has a favourable influence in those cases of profuse menstruation which are dependent upon the climacteric and in patients in whom marked pathological changes can not be demonstrated. The nature of this action, whether oxytocic or dependent upon some hæmic changes, has not been determined. It is safe, however, not to place too much reliance upon uncorroborated evidence of this nature as to the influence of drugs which have been in the market for only a short time. Proof exists that salipyrine is quite efficient in allaying the symptoms of fever and pain, and, through one of its component parts, those of the rheumatic affections. Benefit from its use is alleged to have been obtained in a great variety of other conditions, but the testimony of one observer is not sufficiently strong to induce one to throw aside older and well-tried medicines. A longer time must elapse before a correct judgment as to the virtues of salipyrine can be given.

The dose of salipyrine varies with the condition for which it is administered. When given as an antipyretic, an average dose is from 15 to 30 grains, depending upon the height of the temperature. The larger the dose, the more permanent and stronger the thermolysis. For acute articular rheumatism, 15 grains may be given at hourly intervals until 2 drachms have been taken. The chronic forms of rheumatism require larger and longer continued doses. For neuralgia, 15 grains is an average dose, though 8 grains may accomplish the same result. In the treatment of influenza, 15 grains, three times daily, is an average dose which seems to accomplish the purpose of its administration. Salipyrine may be given in the form of powder, in wafers, or in capsules, or it may be taken in a mixture containing glycerin to hold it in suspension.

SAMUEL M. BRICKNER.

SALITHYMOL, described as a thymol ester of salicylic acid,

$$C_6H_4{<}^{OH}_{COO.C_{10}H_{13}O}{}'$$

occurring as a sweetish crystalline powder, insoluble in water, but readily soluble in alcohol and in ether, has been recommended as an *antiseptic*, but it is advisable not to make use of it in practice until further reports of experience with it have been made.

SALIVIN.—See PTYALIN.

SALIX.—Several species of willow have been used in medicine. The bark of the white willow, *Salix alba*, was formerly official. It is *bitter* and feebly *tonic*. The catkins, leaves, and shoots of the weeping willow, *Salix babylonica*, are also *tonic* and have been reputed *anthelminthic*. The bark of the North American black willow, or pussy willow, *Salix nigra*, especially the root-bark, is also a *bitter tonic*. It is said also to be a powerful *antaphrodisiac* and *sedative to the sexual organs*, to be preferred to the bromides, for the reason that it has no depressing effect, in *spermatorrhœa, prostatorrhœa, ovarian hyperæsthesia, dysmenorrhœa*, and *uterine neuralgia*. As it is not recognised in the pharmacopœias, there are no official preparations; an English firm, however, Messrs. Christy & Co., of London, make a fluid extract (said to have a rough and very persistent astringent taste) the dose of which is from ½ to 1 fl. drachm, and a cordial (known as salix nigra cordial) which may be given in doses of from 2 to 4 fl. drachms (*Brit. Med. Jour.*, March 24, 1888). All the species contain *salicin* (*q. v.*).

SALOCOLL.—This is the trade name of phenocoll salicylate. It is used in doses of from 10 to 15 grains for the same purposes as phenocoll.

SALOL (U. S. Ph.), *salolum* (Ger. Ph.), $C_6H_5C_7H_5O_3$, is a salicylic phenol ether, and probably not, as is commonly stated, a true salicylate of phenol. It consists of 60 parts of salicylic acid and 40 of carbolic acid. It occurs as a white powder having a crystalline structure with a faint odour resembling that of carbolic acid, but without taste. It is totally insoluble in water, but freely soluble in alcohol, in ether, and in the fixed and volatile oils.

Locally, it acts as an *antiseptic*, like iodoform, in preventing the growth of bacteria, but not destroying them when present. It is commonly believed that when salol is taken internally it is not digested by the gastric juice. While there seems to be doubt as to the truth of this assertion, it is a fact that it is chiefly acted upon by the pancreatic juice. Irritation of the stomach is very rarely observed, which would seem to show that no carbolic acid is liberated in that organ. Its therapeutic value seems to depend upon the fact that in the intestinal canal it is decomposed into its constituent elements—salicylic acid and carbolic acid. It is excreted by the kidneys. When large doses are given, the urine assumes the same dark, smoky hue which appears when carbolic acid is being administered. Salol has been proved to have a decided disinfecting power upon the urine. In large doses it has a very marked *antipyretic* action, which occurs suddenly from fifteen to twenty minutes after the drug has been given, and is accompanied by profuse sweating. Unlike what occurs after the use of many other antipyretics, the rise of temperature at the end of the pe-

riod of apyrexia is not marked by a rigour. Salol possesses also decided *analgetic* properties. They are most marked in cases of pain which are due to *rheumatism*.

A review of the physiological properties of salol furnishes a key to its therapeutic uses. It was first introduced as a substitute for salicylic acid and the salicylates. Its advantages over these drugs are its tastelessness, the ease of its administration, and its freedom from causing unpleasant symptoms. It unquestionably has a most decided power over the pain and fever of *rheumatism*. It does not prevent cardiac complications, and, unless its use is continued after the symptoms are relieved, relapses are apt to follow. In that large class of diseases designated by such names as *muscular rheumatism*, *myalgia*, and *lumbago*, which are marked by more or less acute and localized pain or by vague and uncertain pains and soreness of the muscles, salol is a most valuable remedy, but, after full trial, it does not seem to be regarded by the best observers as equal to salicylate of sodium in acute rheumatism.

In *migraine*, the various forms of *neuritis*, and *the pains of locomotor ataxia*, salol sometimes shows a remarkable power of affording relief.

In *intestinal catarrh*, especially when the duodenum is involved, in *catarrh of the bile ducts*, and in *jaundice*, salol has been found to be a remedy of decided value. It is alleged that in *hepatic catarrh* with a tendency to inspissation of the bile, it also acts most efficiently by rendering the bile more fluid, and thus dissolving hardened masses. In *diarrhœa*, especially the so-called *summer diarrhœas of children*, salol has come to be largely used and sometimes proves of the greatest value. When the stools are fœtid and of bad odour, the use of salol in the treatment has a most satisfactory effect, the drug acting apparently as an antiseptic. It may be added to the regular bismuth or other diarrhœa mixture.

In diseases of the urinary tract salol has proved to be a drug of the utmost value. This would readily be inferred from the fact that it is excreted by the kidneys. In *pyelitis*, *cystitis*, or *urethritis* it may be given with great advantage, as it does much to render the urine antiseptic and unirritating. Its value in these conditions is almost universally conceded by authorities upon genito-urinary diseases.

Salol has been a favourite drug in the treatment of *simple influenza* and of the *grippe*. As commonly combined with phenacetine or acetanilide, it has a marked effect in relieving the pains and discomforts of these disorders.

Recently salol has been considerably used as an *antiseptic* dressing for *sores* and *ulcers*. It is sometimes used as a dusting powder instead of iodoform, its lack of odour making it far more agreeable than that preparation. It is also sometimes mixed with oil, balsam, or ointment.

The dose of salol varies greatly with the case and with the purpose for which it is used. In rheumatism and as an antipyretic the dose ranges from 15 to 30 grains, but it has been given in doses of 60 grains. In so-called muscular rheumatism, in influenza, and in migraine it is given in doses of from 4 to 8 grains from three to five times a day. In cystitis 5 grains are commonly given every three to six hours. In diarrhœa 5 grains are usually given, children of one year receiving 1 or 2 grains.

[Colombini (*Riforma medica*: *Med. Record*, February 15, 1896) has found salol dissolved in liquid vaseline a very useful and unirritating *antiseptic* application for *ulcers*. Reynier (*Jour. des praticiens*, April 4, 1896; *N. Y. Med. Jour.*, April 25, 1896) has employed salol as an antiseptic dressing after operations for *tuberculous disease of bone*. This dressing consists of salol liquefied at a temperature of 104° F. and mixed with naphthol, aristol, and iodoform. After trephining of the bone and cleansing of the tuberculous region, the cavity is filled with the melted salol, and a complete and aseptic occlusion is obtained. Furthermore, union by first intention of the sub-adjacent skin may be effected with this method of closure, which is similar to plugging of the teeth. M. Reynier states that he has operated on six patients and employed this dressing, with the result that he has obtained a rapid recovery in a few days after filling the osseous cavity with this antiseptic mixture, and that immediate union of the skin and the subcutaneous connective tissue has taken place.

A mixture of salol and antipyrine has proved a very efficient application in the treatment of *uterine hæmorrhage*. Berman (*Allg. Wiener med. Ztg.*, 1895, No. 35; *Ctrlbl. f. Gynäk.*, March 15, 1896) gives the following account of Labadie-Lagrave's method of using it: Equal quantities of the two drugs are heated together in a test tube over a lamp until a deep-brown mixture forms. As soon as this has cooled sufficiently, a film of cotton on an applicator is dipped into it and passed into the uterine cavity. This is done two or three times in succession. The procedure is said to be painless and not to be followed by unpleasant effects. It is said also that a second resort to it is rarely necessary. Labadie-Lagrave has been using it since the year 1893, and with better results than with any other method. In cases of *fungous endometritis* the application should be made after curetting. It is not only hæmostatic, but also antiseptic, and tends to prevent a relapse.

Camphorated Salol.—In a report on dermatology, Dr. John T. Bowen, of Boston (*Boston Med. and Surg. Jour.*, September 19, 1895), remarks that Elsenberg has used this preparation in various cutaneous affections for two years, and has found it of special value in *furuncles* and *carbuncles*. It is prepared by moistening 1 part of camphor with a few drops of alcohol, and rubbing this in a porcelain mortar with 1·4 part of salol until a transparent liquid is obtained. When the liquid has been applied from twelve to twenty-four hours the pain diminishes, the redness and inflammation of the adjoining parts disappear, and the tumour becomes progressively smaller, without the formation of pus. As a rule, the

secretion obtained from the vesicle at the point of the furuncle yields a pure culture of the *Staphylococcus aureus* on nutrient media, as do also bits of the infiltrated tissue. After camphorated salol has been used for twenty-four hours, no such cultures can be obtained. When suppuration has already taken place in the furuncle, and after the slough has been removed, the pain and hyperæmia may be much lessened and the suppuration diminished by the application of the camphorated salol. The healing process then advances quickly, a slight discoloration, and some infiltration being felt only for a short time. The method of using the drug is to lay bare the point of the furuncle, or, in the case of carbuncle, to make several moderately deep incisions, in order to facilitate the penetration of the mixture into the infiltration; afterward the lesion and the surrounding hyperæmic parts are covered with cotton compresses soaked in camphorated salol, and an impermeable covering is placed over it.]—FLOYD M. CRANDALL.

SALOPHENE, or *salophen*, is chemically a salicylate of amidophenol. It is a derivative of salol and contains 50·9 per cent. of salicylic acid. It occurs as a white, odourless, tasteless powder, composed of small white lamellar crystals. It is not soluble in water, but is very soluble in alcohol and in ether or an alkaline solution. It is not official.

It is employed as a substitute for salol and salicylic acid, its chief advantage over salicylic acid being that it is unirritating and tasteless, and is said not to be depressing. It is indicated in the same conditions which would suggest the use of the salicylates. In *acute muscular rheumatism* it is alleged to have been used with extremely good results. It may be given for considerable periods of time without causing nausea, loss of appetite, tinnitus, or other unpleasant effects that are frequently observed from the use of salicylic acid and its derivatives. In chronic rheumatism it is less efficient than in the acute form. It is given with good results in *migraine* and various *neuralgic affections*. Like salol, it has been used as an *intestinal antiseptic*. It has been recently lauded as efficient in relieving the neuralgic pains and headache of *influenza*. For this disease it is usually combined with phenacetine. At the present writing the drug has not been sufficiently tested to warrant dogmatic statements as to its true value. It is administered in the form of tablet or pill, or may be given dry on the tongue. The dose ranges from 5 to 20 grains, which may be given from three to six times a day. The maximum daily amount should not be over 1½ drachm.

[Salophene seems to have been introduced into practice by Dr. Paul Guttmann (*Berliner klin. Woch.*, 1891, No. 52). Dr. William H. Flint (*N. Y. Med. Jour.*, July 30, 1892) gives a summary of Dr. Guttmann's article, together with the following formula, $C_6H_4OH,C_6H_4N\begin{cases}\text{COO}\\ \text{H}\\ \text{COCH}_3\end{cases}$, which is that assigned to the drug by Dr. Siebel, of the Elberfeld Chemical Works. From the fact that in the system salophene was split up into sodium salicylate and acetyl paraamidophenol, Dr. Guttmann inferred that it would be useful in the treatment of *rheumatism*. In his article he reported his experience with it in four cases of acute rheumatism and in a number of cases of the chronic form of the disease. He found that, to obtain the best results, as much as 60 grains had to be given in the course of twenty-four hours, that this amount might be increased with advantage to 90 grains, and that these doses must be given daily until the subsidence of the symptoms, when they might be somewhat reduced. Dr. Flint reports six cases of acute rheumatism treated in the Presbyterian Hospital, New York, with 15-grain doses of salophene every three hours and 10-grain doses of sodium bicarbonate three times a day. In all but one of these cases the pain was quite relieved, the redness dispelled, and the temperature reduced to the normal point on the second or third day of treatment. The exceptional case was that of a poor woman, in need of an asylum, who may have exaggerated the intensity of her pain in order to prolong her sojourn in the hospital. In none of the cases was the heart's action at all weakened or the digestion impaired by the remedy. In chronic rheumatic arthritis Dr. Flint has met with very poor results in the main from the use of salophene.

In the *New York Medical Journal* for May 25, 1895, Dr. Bertram H. Waters reports twenty-five cases of *acute rheumatism* treated with salophene in Dr. Andrew H. Smith's service in the Presbyterian Hospital, New York. In almost every case improvement was rapidly effected, and the average length of time for reduction of fever was six days, as against eight days for oil of wintergreen and nine days for sodium salicylate. No complication more serious than the extension of the process to other joints was observed. The average length of hospital treatment was, under salophene, eighteen days; under oil of wintergreen and sodium salicylate, each, twenty-five days approximately. These periods include the after-treatment with iron and tonics. In no cases were gastric, renal, or constitutional disturbances observed.

Dr. Harry S. Pearse, of Albany (*N. Y. Med. Jour.*, March 14, 1896), reports fourteen cases of *acute rheumatism* treated with salophene in Bellevue Hospital, New York, in the services of Dr. Dana, Dr. Fowler, and Dr. Lambert. Dr. Pearse's remarks are to much the same purpose as Dr. D. B. Hardenbergh's, in a previous report of the cases treated in the same wards (*Med. Record*, July 29, 1893). Dr. Pearse says that, according to Dr. Whipman (*Report of the Collective Investigation Committee of the British Medical Association*), in the treatment of a hundred and seventy-three cases with the salicylates, the average duration of fever was 8·65 days. In a hundred and ninety cases collected by Wardner the average was 5·5 days; in a hundred and fifty-six cases by Owen, 3·66 days; in fifty-five cases, according to Howard, in Pepper's *System of Medicine*, 7·25 days; in ten by Hardenbergh, 6·11 days, treated exclusively with

salophene. According to Whipman, in a hundred and sixty-seven cases treated with the salicylates the average duration of the whole attack was 19·03 days; ten by Hardenbergh, who used salophene, gave an average of ten days. In Dr. Pearse's own cases the average was 10·25 days. This conclusion is perhaps valueless, he adds, because of the necessity of transferring some of the patients to another hospital in early convalescence to make room for incoming patients. The average daily amount given was 1½ drachm in 15-grain doses every four hours. This could be continued indefinitely with no untoward effects. One patient took 15 grains every four hours during the day for a month. With each 15 grains of salophene, 15 or 20 grains of bicarbonate of sodium were combined, as advised by Flint in the salicylate treatment, for the reason that there is less probability of cardiac complications in the alkaline treatment than in any other. There were no symptoms of gastric irritation, cardiac depression, or renal or cerebral involvement in any one of the salophene cases which could be attributed directly to salophene.

Dr. Pearse gives some data, prepared by Dr. Charles Rice, the chemist to the Department of Public Charities, from which it appears that from the year 1892 to 1895 the amount of salicylic acid employed in Bellevue Hospital rose from 93 to 170 pounds, that of oil of wintergreen rose from 18 to 22 pounds, that of sodium salicylate declined from 83 to 60 pounds, and that of salophene rose from 8 to 430 ounces. The employment of salophene in the hospital, he says, has been confined pretty closely to cases of acute rheumatism, and the increase in the amount of the drug consumed seems to bear testimony to its growing favour.

Dr. Richard Drews, of Hamburg (*Ctrlbl. f. innere Med.*, November 23, 1895), has observed such good effects of the use of salophene in the treatment of the *nervous form of influenza* that he does not hesitate to declare the drug a specific for that variety of the disease. In the case of adults severely and suddenly attacked he gives 30 grains and then 15 grains every two or three hours until from 75 to 90 grains have been taken in the course of twenty-four hours; if the symptoms are of little intensity, or if the patient is a weak person, especially a woman, doses of from 8 to 12 grains every two or three hours are often sufficient to speedily allay the various neuralgic pains and to cure the attack entirely in two or three days. To children he gives from 5 to 8 grains at a dose, according to the age—from 60 to 75 grains in twenty-four hours.]

FLOYD M. CRANDALL.

SALT, COMMON.—Sodium chloride. See under SODIUM.

SALT, CARLSBAD, ARTIFICIAL, *sal carolinum factitium* (Ger. Ph.), is a dry white powder consisting of 22 parts of dried sodium sulphate, 1 part of potassium sulphate, 9 parts of sodium chloride, and 18 parts of sodium bicarbonate. Ninety grains of it, dissolved in a quart of water, form a solution closely resembling the natural Carlsbad water. Artificial effervescent Carlsbad salt, *sal carolinum factitium effervescens* (N. F.), is made by triturating together 320 parts of artificial Carlsbad salt, 630 of sodium bicarbonate, 560 of tartaric acid, and 290 of sugar, all previously well dried and in fine powder. About 87 grains of this powder, dissolved in 6 oz. of water, correspond to the essential ingredients of Sprudel water. (See WATERS, MINERAL.)

SALT, EPSOM.—See *Magnesium sulphate*, vol. i, page 592.

SALT, MONSELL'S.—Iron subsulphate (see vol. i, page 549).

SALTPETRE.—See POTASSIUM NITRATE.

SALT, ROCHELLE.—See *Potassium and sodium tartrate*, under POTASSIUM TARTRATES.

SALUBRINE.—This fanciful name seems to have been given to two different things, one of which is a French preparation containing salicylic acid, used for preserving articles of food, and the other a Swedish patented medicament consisting of 2 parts of acetic acid, 25 of acetic ether, 50 of alcohol, and 23 of water. Diluted with from two to six times its bulk of water, this Swedish preparation has been recommended as an *antiseptic* and *hæmostatic*, and as an application for *bruises*, for *muscular rheumatism*, and for certain *inflammatory skin diseases*. It has not come into use in America.

SALUMINE.—This is a trade name for aluminum salicylate, used as an *astringent*, especially by insufflation, in *dry catarrh of the nose and pharynx* and in *ozæna*. It is insoluble in water.

SALVES.—See OINTMENTS.

SALVIA (U. S. Ph.), *folia salviæ* (Ger. Ph.).—This drug consists of the leaves of *Salvia officinalis*, or common garden sage. It is *stomachic*, *aromatic*, and slightly *tonic*, and has been used in the treatment of *atonic dyspepsia*, in doses of from 20 to 30 grains. The volatile oil, which in overdoses is poisonous, causing epileptoid convulsions, may be given in doses of from 1 to 2 drops, on sugar, three or four times a day.

SAL VOLATILE.—See AMMONIUM CARBONATE.

SAMBUCUS.—The *sambucus* of the U. S. Ph. is the flowers of *Sambucus canadensis*, or American elder, which is closely allied to the European elder, *Sambucus nigra*, that furnishes *sambuci flores* (Br. Ph.), or *flores sambuci* (Ger. Ph.). Elder is *diaphoretic*, *diuretic*, and *febrifuge*, but is now little used in medicine. The powdered drug may be given in doses of 2 drachms; the distilled water, elderflower water, *aqua sambuci* (Br. Ph.), in doses of a tablespoonful.

SANDAL-WOOD.—Two kinds of wood are known as sandal-wood, or saunders—the white or yellow saunders (*Santalum album*) and the red saunders (*Santalum rubrum*). The former only is of much importance in medicine, chiefly on account of the fragrant oil it contains. The red saunders, *santalum rubrum* (U. S. Ph.), *pterocarpi lignum* (Br. Ph.), is employed as a colouring agent in certain pharma-

cal preparations, such as *Tinctura lavandulæ composita*, and is also sometimes used in tooth powders. It is the wood of *Pterocarpus santalinus*, indigenous to India, especially in the Madras Presidency, and is cultivated in southern India. In the shops the wood is found in chips or in a coarse irregular powder of a brownish-red colour, nearly inodorous, and having a scarcely perceptible astringent taste. It imparts its red colour to alcohol, but not to water.

Santalum album belongs to the order *Santalaceæ*. It is a small tree growing in East India and in some of the islands of the Indian Archipelago. Three varieties of sandal-wood are distinguished in commerce as East Indian, Macassan, and West Indian. The first is the wood *Santalum album*, the second is probably that of some other species of santalum, and the third is a wood imported from Puerto Cabello in Venezuela. *Bucida capitata*, a combretaceous plant, is also known in the West Indies as sandal-wood, but is quite distinct in the odour, both of the wood and of the oil, from true sandal-wood. In India, where in certain sections the production is under government control, the trees are felled after they have attained an age of twenty or thirty years and are allowed to remain on the ground for several months, till the white ants have eaten away the sapwood, which is valueless, leaving the fragrant heart-wood untouched. The trunks are then sawed into billets from 2 to 2½ feet long. The best, or "yellow," wood, which is the richest in oil, comes from trees that have grown slowly in dry and rocky soils, which are favourable to the development of the duramen. Its colour is yellowish brown. The "white" wood is from trees that have grown more rapidly in alluvial lands. It is inferior in quality to the yellow. Sandal-wood is hard and heavy, splits easily, and when cut transversely shows a somewhat waxy lustre with irregular concentric zones alternately lighter and darker in colour. When rubbed or rasped it emits an agreeable odour "suggestive of rose, musk, and lemon." To the taste it is aromatic, bitterish, and slightly acrid.

The oil, *oleum santali* (U. S. Ph., Br. Ph.), is obtained by distillation, usually, from chips of the wood and from its roots. It is a thick oil of a light amber colour and has the characteristic odour of the wood. The taste is at first sweet, later sharp and bitter. It is insoluble in water but imparts its odour to it. It dissolves in alcohol and in ether. It is very often adulterated with copaiba and castor oil.

Although in ancient times it was employed medicinally by the Arabs and Hindus, sandal-wood oil has been used in modern times only since a comparatively recent date. In 1865 Henderson, of Glasgow, introduced its use into Great Britain as a remedy for *gonorrhœa*, and it is for this disease that it is now chiefly employed. Its therapeutic properties are those of the balsamic and terebinthinate remedies generally, and are chiefly shown in controlling excessive secretions from the mucous membranes. When taken internally it is eliminated by the respiratory and urinary organs, as is shown by the odour, which is also sometimes perceptible in the transpiration from the skin. It causes no cutaneous eruptions, unlike copaiba, and is less apt to produce gastric or intestinal disturbance than the latter remedy. It is believed to have some stimulant effect on the organs of digestion. To some patients, however, the taste is so objectionable that its use can not be long continued.

In gonorrhœa it was at first vaunted as a remedy in every way superior to copaiba. It was recommended to be used early in the disease and was supposed to be capable of arresting the discharge in a few days. Some have maintained that it acted by rendering the affected mucous membrane aseptic. The general opinion now is that, while it is more apt to be tolerated than copaiba, it is no more efficacious in gonorrhœa than the latter. Indeed, many regard both copaiba and cubeb as slightly more efficacious than sandal-wood oil. As regards the period of the disease at which its use is indicated, the same rule applies to this drug as to the other balsamics. It should never be administered until after the acute manifestations of the disease have passed.

In *bronchial affections* its use was suggested from the fact of its elimination through the organs of respiration. In *bronchitis* with abundant secretion and in *asthma* it is said to be a remedy of considerable value.

In *diarrhœa* due to a persistent catarrhal state of the intestinal mucous membrane it has also been recommended.

The oil is best administered in capsules containing usually from 5 to 10 drops. In gonorrhœa the dose is from 10 to 20 drops three times a day. In the liquid form the taste is best disguised by cinnamon, as in the following:

℞ Oil of sandal-wood..... ½ fl. oz.;
Dilute alcohol..... 2½ "
Oil of cinnamon..... 25 minims.
Sig.: 1 or 2 teaspoonfuls two or three times a day.

Often it is combined with copaiba, with oleoresin of cubeb, or with matico. The following is recommended as "a peculiarly effective combination," though sometimes disturbing to the stomach:

℞ Balsam of copaiba, } each... ½ fl. oz;
Sandal-wood oil, }
Liquor potassæ..... 6 fl. drachms;
Syrup of orange peel..... 2 fl. oz;
Water, enough to make..... 4 fl. oz.
M. S.: A teaspoonful three or four times a day in a wineglass of water.

EDWARD BENNET BRONSON.

SANDARAC is a resinous body derived from *Callitris quadrivalvis*, a tropical and semitropical evergreen, formerly used in medicine and in pharmacy in the preparation of plasters and ointments. It is of little medicinal importance and is employed chiefly in the arts, in the preparation of varnishes, etc.

SANDERS-WOOD.—See SANDAL-WOOD.

SANGUINAL. — This is a proprietary preparation made by defibrinating fresh bullock's blood and evaporating it to a pilular consistence. Dr. Otto Dornblüth, of Rostock (*Dtsch. Med.-Ztg.*, January 16, 1896; *N. Y. Med. Jour.*, February 8, 1896), gives his experience with a preparation called sanguinal, made by a Cologne firm of apothecaries, who say that it is composed of 46 per cent. of the salts normally found in the blood, 44 per cent. of muscle albumin, and 10 per cent. of hæmoglobin, and therefore corresponds almost perfectly to normal blood in composition. Dr. Dornblüth says that, although he has not lost confidence in the old inorganic preparations of iron, he often observes cases of *debility with nervous symptoms* manifestly due to a defective constitution of the blood in which those preparations of iron fail altogether or at least do far less good than in chlorosis. In many such cases he has found that the effects of sanguinal were surprising; in numerous cases, ranging from the slightest *nervousness* up to the severest forms of *neurasthenia*, in which the previous use of all sorts of preparations of iron had been unavailing, the use of sanguinal speedily brought about an improved condition, manifested by a blooming appearance, a decided feeling of well-being, and a good appetite. The dose of sanguinal he gives as three pills, three times a day, preferably taken before meals. He does not state how much sanguinal each pill contains, so it may be presumed that the drug is in the German market in the form of pills of a certain weight.

SANGUINARIA (U. S. Ph.), or bloodroot, the rhizome of *Sanguinaria canadensis*, for a long time has played an important part in domestic and irregular practice, but it was not until within a relatively recent period that its value was fully recognised by regular practitioners. In small doses, it increases the secretions of the liver and intestines and acts as an *emmenagogue* and *stimulant expectorant;* in larger doses, it is *emetic*, and in improper amounts it is a *depressant narcotic*. It also may be regarded as *alterative*, and may be advantageously employed in *scrofula*, *syphilis*, and other conditions in which such a remedy is indicated. Externally, it and its preparations are *stimulant* and *escharotic*, and may be employed to stimulate *unhealthy surfaces* and to destroy *exuberant granulations*, but for these purposes it is ordinarily not so convenient as other agents. In all forms of *gastroduodenal catarrh* and the *jaundice* due to it, sanguinaria is very useful, as well on account of its specific effect upon the liver and intestines as by its action as a slight stimulant of the gastric mucous membrane.

Amenorrhœa of an atonic nature, in which the pelvic organs appear to be anæmic rather than congested, or that of chlorotic girls, may be advantageously treated with it, but it is better to use aloes or iron or both at the same time, as such a combination appears to be rather more active than any one of the drugs by itself.

[In addition to its emmenagogue properties, sanguinaria is said to be decidedly *abortifacient;* therefore it should be employed only with great caution in pregnant women.]

Increasing, as it appears to, the amount of blood circulating through the pelvic organs, it has been suggested as an *aphrodisiac* when the erections are feeble and diurnal pollution exists, and its employment has been followed in many cases with sufficiently good results to warrant its trial in such forms of *impotence*. As a *stimulant expectorant*, with slight nauseating effects, it is very useful in the later stages of *acute bronchitis*, and in some cases of *asthma* it appears to be of value. *Chronic nasal catarrh* is sometimes improved by the insufflation of small quantities of the powder conjoined with the internal administration of one or another of the preparations of sanguinaria.

Although it is *emetic*, its use to produce vomiting should be avoided, as it is very depressing and apt to excite more or less irritation of the gastric mucous membrane.

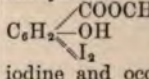
All the properties of the official sanguinaria are contained in an unofficial alkaloid, *sanguinarine*. Nitrate of sanguinarine may be given as an emmenagogue, aphrodisiac, expectorant, or alterative in doses of $\frac{1}{12}$ of a grain, or as an emetic in doses of $\frac{1}{4}$ of a grain. The dose of the tincture, *tinctura sanguinariæ* (U. S. Ph.), is from 30 to 60 minims; that of the fluid extract, *extractum sanguinariæ fluidum* (U. S. Ph.), is from 3 to 5 minims. The dose of the drug itself is from 1 to 5 grains, but the powder is rarely employed. A weak decoction has been used as a gargle in *sore throat*, particularly in that of scarlet fever.

RUSSELL H. NEVINS.

SANGUINARINE.—See under SANGUINARIA.

SANGUIS.—See BLOOD.

SANOFORM. — Dr. Alfred Arnheim, of Berlin (*Allg. med. Ctrlztg.*, 1896, No. 37; *Disch. Med.-Ztg.*, May 14, 1896; *N. Y. Med. Jour.*, May 30, 1896), says that sanoform was brought into notice by Courant and Gallinek in 1895, and has been experimented with by Lohnstein. Chemically, it is said to be a diiodosalicylic-acid methyl ether having the formula



. It contains 62·7 per cent. of iodine and occurs in white needles that are entirely odourless and tasteless. It is moderately soluble in alcohol and readily soluble in ether and in vaseline, so that it is suitable for use in medicating gauze, collodion, and vaseline. Its melting point is above the temperature required for sterilizing gauze. It is said to be not at all poisonous. The author mentions its having been used as a *substitute for iodoform* in seventy-two cases, consisting of twenty-two of *soft chancre*, twenty of *hard chancre* (sometimes together with mercurial treatment, sometimes before it), six of *bubo*, sixteen of *phimosis*, three of *wounds from the excision of ulcers*, and five of *paronychia* or the after-treatment of *open abscesses*. The pure powder was dusted on to the ulcerous surfaces, and after the suppuration had been

checked a 10-per-cent. ointment was applied. The same course was followed in the treatment of fresh wounds. In general, the improvement was comparatively rapid. In a few of the cases of soft chancre, and especially in almost all of those in which the prepuce had to be cut, the rapidity of the healing process was striking. There were instances, however, in which the morbid condition followed its usual course of two, three, or four weeks. Sanoform, says Dr. Arnheim, is inferior to iodoform as a healing agent, but has the advantages of its freedom from odour and its perfectly non-poisonous character. It is not more expensive than iodoform. It is made at the Höchst dye-works formerly known as Meister, Lucius, & Brüning's.

SANTALUM RUBRUM (U. S. Ph.), **SANTAL-WOOD.**—See SANDAL-WOOD.

SANTONICA (U. S. Ph., Br. Ph.), or Levant wormseed, is the dried unexpanded flower heads of *Artemisia pauciflora*. *Flores cinæ* (Ger. Ph.) are the flower heads of a Turkestan variety of *Artemisia maritima*. Both santonica and *flores cinæ* were formerly employed in doses of from 10 to 30 grains in the treatment of *ascarides*, but they have now been superseded by their active principle, *Santonin*, the *Santoninum* of the pharmacopœias, on account of the smaller dose necessary and its definite composition.

Santonin occurs in flattened crystals, normally colourless, but yellowish after exposure to the light and air, and practically insoluble in the ordinary menstrua. It is best administered combined with sugar. Ordinarily it imparts an orange hue to the urine, and large, but not necessarily dangerous, doses may give rise to headache and slight dizziness, and affect the vision so that objects appear yellowish or greenish. In overdoses it may cause vertigo, tetanoid spasms, vomiting, cold sweats, chilling of the surface of the body, loss of consciousness, and failure of the respiration. No special rules for the treatment of cases of poisoning can be laid down, as there is no physiological antidote to its action, and urgent symptoms must be combated on general principles.

To obtain the maximum efficiency of this remedy against the *Ascaris lumbricoides*, it is desirable to combine it with castor oil or to administer the latter shortly after its use. Not so desirable, but yet fairly useful, an adjuvant is calomel in ordinary cathartic doses. The commonest form of its administration is that of a troche. The *trochischi santonini* of the U. S. Ph. contain ¼ a grain each of santonin, while those of the Br. Ph. are of double that strength, and those of the Ger. Ph. contain each only ½ of a grain. In whatever form it is employed, the dose must be given in the morning after the precautions noted in the article on ANTHELMINTHICS have been observed, and followed by a cathartic, unless it has been given combined with one. Under ordinary circumstances it is proper to repeat the dose for three successive mornings. If it is so desired, a troche may be given to young children three or four times a day, and usually there is little difficulty in inducing them to eat it. Suppositories containing from 2 to 3 grains of santonin are sometimes used in the treatment of *threadworms*, but are not so efficient as other measures. In *tobacco amaurosis* and other functional forms of amaurosis santonin has been employed with reported good results, also in *amenorrhœa* of the anæmic type. *Nocturnal incontinence of urine in children* has been relieved by small doses when other remedies had failed, but the cases in which it will prove useful can not be distinguished from those in which it will fail. The usual dose for an adult is from 2 to 4 grains, and for a young child from ¼ to ½ a grain.

Sodium santoninate has been employed for the same purposes as santonin, but is improper to use, as it is soluble and readily absorbed. Moreover, considering the ease with which santonin may be administered, there is little or no reason why more dangerous preparations should be employed. Gingerbread, biscuits and similar articles may have santonin incorporated with them if it is desired, but they are not to be recommended except in the case of very young children to whom it is difficult to administer medicine.

The roundworms so common among dogs may be expelled by 2- to 3-grain doses, which can be mixed with the food or administered in a bolus.—RUSSELL H. NEVINS.

SANTONIN.—See under SANTONICA.

SANTONINOXIME, $C_{15}H_{18}O_3.NOH$, is obtained by treating 5 parts of santonin with 4 parts of hydroxylammonium chloride and 50 parts of 90-per-cent. alcohol, with the addition of from 3 to 4 parts of calcium carbonate, boiling for six or seven hours, and adding to the mixture from 4 to 5 times its bulk of water heated almost to boiling, whereupon the santoninoxime separates in the form of white needles. It is insoluble in ordinary menstrua. It has been recommended as a substitute for santonin as an *anthelminthic*, on the ground that it does not give rise to poisoning. It requires to be given in larger amounts than santonin—¾ of a grain for children two or three years old, 1½ grain for those between three and six years old, 2 grains for those between six and nine years old, and 5 grains for adults, divided into two doses to be taken an hour or two apart and followed by a cathartic.

SAPO.—See SOAP.

SAPOCARBOL.—This is a German proprietary mixture of crude carbolic acid and potash soap, a brownish-yellow syrupy liquid, analogous to creolin and used for the same purposes.

SAPOLANOLIN.—This is Stern's name for a mixture of 2 parts of *sapo kalinus* (Ger. Ph.), and from 2 to 2½ parts of anhydrous lanolin, recommended as a suitable basis for ointments to contain any drug except salicylic acid.

SAPONARIA.—*Saponaria officinalis*, or soapwort, owes whatever medicinal properties it possesses to the presence of *saponin*, a very powerful paralyzer of the voluntary and involuntary muscles. It has been tried as a *local*

anæsthetic and as an *antipyretic*, but with no good results. The root of the plant has been assumed to have the same alterative properties as sarsaparilla, but is not held in high esteem, and there would seem to be no good reasons for its employment. The powdered root may be given in doses of from ½ to 1½ drachm three times a day. (See SAPONIN.)

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SAPONIN.—This substance, first discovered in *Saponaria officinalis*, has been supposed to be a glucoside, but it is doubtful if it is in reality a definite chemical principle. Substances closely resembling the saponin of soapwort have been found in a great number of plants. Saponin is highly poisonous, acting as a paralyzer of the heart and, if introduced into the blood unchanged, causing the death of the corpuscles; fortunately, it is very difficult of absorption from the alimentary canal. It should not be used in medicine. Its paralyzing action on the heart is said to be antagonized by digitalis.

SAPO VIRIDIS.—Green soap (see under SOAP).

SAPROL.—This mixture of phenol, cresols, and various other constituents is an oily, tarry liquid having the odour of carbolic acid. It was introduced as a *disinfectant*, but does not seem to have come into general use.

SARRACENIA PURPUREA, a North American nymphæaceous herb known as side-saddle plant, is now but little used in medicine. It is *diaphoretic*, *diuretic*, and *stomachic* in its effects, and is employed to some extent as a remedy for *atonic dyspepsia*. A tincture, of the strength of 1 part of the rhizome to 8 parts of alcohol, may be given in teaspoonful doses three times a day.

SARSA.—See SARSAPARILLA.

SARSAPARILLA (U. S. Ph.), *sarsæ radix* (Br. Ph.), *radix sarsaparillæ* (Ger. Ph.), is the root of *Smilax officinalis* (Br. Ph) and of several other species of the same genus (U. S. Ph.). At one time it had a high reputation in the treatment of *syphilis*, *rheumatism*, *scrofulous affections*, and a number of *diseases of the skin*, but at the present time is rarely employed save in the tertiary stage of the first-named disease, and even in that it is not held in high esteem. It probably possesses slight *tonic* and *alterative* properties, and is highly regarded by the laity as a "blood-purifier," to be taken during the spring months, and it certainly possesses the merit of being entirely harmless. After a long-continued course of mercury in syphilis it appears to assist in restoring the system to its normal condition. The smoke furnished by its slow combustion is said to mitigate the violence of an attack of *asthma*, but, as the smoke from many practically inert substances has a similar effect, there is presumably no specific action in this case.

A simple decoction, *decoctum sarsæ* (Br. Ph.), may be given in almost any quantities. The compound decoction, *decoctum sarsaparillæ compositum* (U. S. Ph., Ger. Ph.), *decoctum sarsæ compositum* (Br. Ph.), varies somewhat in composition according to the different pharmacopœias. It may be given in doses of from 4 to 6 fl. oz. as often as desired, and appears to be slightly sudorific and to render those who are taking it liable to catch cold, so it is well to advise against undue exposure during its use. The decoction of Zittmann, *decoctum Zittmanni*, contains a small amount of senna, together with several more or less inert substances, and is a very popular German remedy. It is often combined with mercurials in the treatment of *syphilis*. The fluid extract, *extractum sarsaparillæ fluidum* (U. S. Ph.), or liquid extract, *extractum sarsæ liquidum* (Br. Ph.), can be combined with other remedies rather more conveniently than a decoction. The dose of the British liquid extract is from 2 to 4 fl. drachms; that of the U. S. fluid extract is from 20 to 60 minims.

The compound fluid extract, *extractum sarsaparillæ compositum* (U. S. Ph.), is practically a condensation of the compound decoction, and is given in doses of from 20 to 60 minims. The compound syrup, *syrupus sarsaparillæ compositum* (U. S. Ph.), is given in doses of ½ a fl. oz., and is often made the vehicle for the administration of corrosive sublimate, but improperly, as precipitation of the mercurial is apt to result.—RUSSELL H. NEVINS.

SASSAFRAS.—The *sassafras* of the U. S. Ph. is the bark of the root of *Sassafras variifolium;* the *sassafras radix* of the Br. Ph. and the *lignum sassafras* of the Ger. Ph. are the chips or shavings of the root of *Sassafras officinale*. As there is only one species, Salisbury's species name *variifolium*, adopted in the U. S. Ph., does not indicate that the plant that is official in the United States is different from that which is recognised in Europe. The pith also is official as *sassafras medulla* (U. S. Ph.). The bark of the root alone is medicinal; the wood is inert. The root-bark of sassafras is highly fragrant and of an agreeable aromatic taste. It is slightly *stimulant* and *astringent*. Sassafras is used almost entirely to impart an agreeable flavour to mixtures and to the beverage popularly known as "root beer." The fresh leaves of the sassafras tree are slightly aromatic. If chewed, they are highly efficient in allaying *thirst* when water can not be obtained. A mucilage, *mucilago sassafras medullæ* (U. S. Ph.), made from the pith, may be taken freely as a *demulcent* in *painful affections of the mouth and throat*. The volatile oil, *oleum sassafras* (U. S. Ph.), is used almost entirely for flavouring purposes, but it may be given as a *carminative* in *flatulent colic*, in doses of from 2 to 10 drops, on sugar. In overdoses it is decidedly poisonous. It contains safrol.

SASSY-BARK.—See under ERYTHROPHLŒINE.

SAUNDERS.—See SANDAL-WOOD.

SAVINE, *sabina* (U. S. Ph.), is the fresh and dried twigs and leaves of *Juniperus Sabina*, an evergreen shrub, from three to fifteen feet high, which grows in the northern United States and in Europe. It is frequently adul-

terated with red cedar (*Juniperus virginiana*), which it closely resembles. Oil of savine, *oleum sabinæ* (U. S. Ph., Br. Ph.), a volatile oil obtained by distillation, is its most important medicinal ingredient.

Savine has an exceedingly unpleasant odour and a pungent and acrid taste. After the ingestion of large doses, the characteristic odour of the drug is given off in the breath and is pronounced in the perspiration and the urine. Applied to the skin, the oil acts as a *rubefacient* and a *vesicant*. Taken internally in small doses, its principal effects are a more rapid action of the heart, increased arterial tension, followed by relaxation, and more abundant cutaneous, bronchial, and renal excretions. It also stimulates the circulation in the pelvic organs and increases the menstrual flow. In toxic doses it produces violent gastro-intestinal irritation, strangury, and hæmaturia.

Savine has been used as an *abortifacient*, as an *emmenagogue*, as an *anthelminthic*, and in the treatment of *chronic gout*. Used in quantities sufficient to produce abortion, it is an extremely dangerous agent. As an emmenagogue, Pereira regards it as one of the most active of the materia medica. Direct emmenagogues like savine, however, are now seldom employed. The drug is said to be useful in the treatment of *atonic menorrhagia*.

Of the dried tops, the dose is from 10 to 15 grains or more; of the oil, from 1 to 5 minims, best given in emulsion or in capsules. The dose of the fluid extract, *extractum sabinæ fluidum* (U. S. Ph.), is from 5 to 15 minims; that of the tincture, *tinctura sabinæ* (Br. Ph.), from 20 minims to 1 fl. drachm. The ointment, *unguentum sabinæ* (Br. Ph.), was formerly used externally as an irritant.—CHARLES JEWETT.

SAXOL.—This name has been given to a "very pure petroleum in a liquid state" which "seems to facilitate the absorption of any medicinal matter which may be mixed with it." So it is stated in *Clinical Sketches* for August, 1895. It does not seem to have been used much.

SAXOLINE.—See VASELINE.

SCAMMONY, *scammonium* (U. S. Ph., Br. Ph.), is a gum-resinous exudation from the living root of *Convolvulus Scammonia*, a plant native to Syria and neighbouring localities. The drug occurs in irregular pieces or flattened, circular cakes of a grayish colour, a peculiar odour, and a slightly acrid taste. It is brittle, and the broken surface is shining and somewhat porous. Its powder is light gray. The scammony of the market is seldom absolutely pure, and absolutely pure scammony, *virgin scammony*, as it is called, is difficult to obtain. The so-called *scammony in shells* was formerly to be had, and represented the drug in its purity. The peculiar name of the product was given to it because it was contained in the shells in which the exudation had been collected and dried. *Factitious scammony* is often substituted for the genuine scammony. It is compounded of various resinous and other substances. Its manufacture is done especially in southern France. The active principle of scammony is a resin which occurs in the pure drug in quantities which vary from 80 to 90 per cent. This resin is identical with *jalapin*, the resin of *Ipomœa orizabensis*, or male jalap. Besides the resin, scammony contains gum and extractive. The quantity of the resin which scammony contains is so variable, and adulteration is so often practised, that the resin should always be employed in preference to the crude drug. Resin of scammony, *resina scammonii* (U. S. Ph.), *scammoniæ resina* (Br. Ph.), occurs in yellowish or brownish, brittle pieces, or in a yellowish-white or grayish powder. Its odour and taste, though slight, are peculiar. It is freely soluble in alcohol. Although the U. S. Ph. directs that resin of scammony shall be prepared from scammony, the Br. Ph. provides that it may be prepared not only thus, but also from dried scammony root, *scammoniæ radix* (Br. Ph.), which is made official for this purpose.

Scammony and its resin are *cathartics* of much vigour and even severity of action, and because of this they are seldom administered save in combination with less powerful cathartic remedies whose activity they serve to enhance and by which their own violent properties are made less. The griping which scammony causes may be of great intensity. The action of scammony is similar to that of jalap, but it has a more drastic effect. Scammony is useful in cases requiring a thorough and vigorous intestinal evacuation; it is suitable, therefore, in *obstinate constipation* in the early days of *inflammatory* and *febrile diseases*, and sometimes to aid in the dissipation of *dropsical effusions*. It is contra-indicated in intestinal inflammation. Scammony may be given in emulsion, griping being mitigated by the addition of an aromatic. The dose of the pure drug is from 5 to 15 grains. Resin of scammony is to be preferred to scammony itself, because of its constancy of strength. The dose of the resin is from 4 to 8 grains, and it is conveniently given emulsified with milk. A similar emulsion has official recognition, for scammony mixture, *mistura scammonii* (Br. Ph.), is composed of 1 part of powdered scammony triturated with 146 parts of milk until a uniform emulsion is obtained. This mixture must be prepared fresh when needed. The dose is from 1 to 3 fl. oz. Confection of scammony, *confectio scammonii* (Br. Ph.), contains 48 parts of powdered resin of scammony, 24 parts of powdered ginger, 2 parts of oil of caraway, 1 part of oil of cloves, 48 parts of syrup, and 24 parts of clarified honey. The dose is from 10 to 30 grains. Compound scammony pill, *pilula scammonii composita* (Br. Ph.), is composed of 1 part each of resin of scammony, resin of jalap, powdered curd soap, and strong tincture of ginger, and 2 parts of rectified spirit, mixed and reduced by evaporation to a pilular consistence. The dose is from 5 to 15 grains. Compound powder of scammony, *pulvis scammonii compositus* (Br. Ph.), contains 4 parts of powdered resin of scammony, 3 parts of powdered jalap, and 1 part of powdered ginger. The dose is from 10 to 20 grains.—HENRY A. GRIFFIN.

SCARIFICATION is the production of small incisions. The object of the practice is the relief of *local congestion* and *inflammation*. By scarification of inflamed tissues the congestion is lessened by direct abstraction of blood from the engorged vessels, effused matters are permitted to escape, and painful and perhaps dangerous tension is removed from the affected part. The treatment of localized inflammations of the skin and mucous membranes by early incision is a surgical rather than a medical affair, of which information must be sought in surgical works, but the more minute incisions to which the name scarification is properly confined, though certainly surgical and differing from other incisions only in degree, may not inaptly be briefly considered here. The condition in which scarification is of most momentous importance is *œdema of the glottis*, but it is frequently beneficial in *acute inflammation of the tonsils* and may be required in *conjunctivitis* when congestion and swelling are extreme. In the first-named condition care must of course be had to avoid cutting the tongue, which is best accomplished by protecting the blade of the knife, all save the tip, with rubber plaster or a similar material. In some cases scarification of the uterine cervix is of benefit. Scarification has also been done for the relief of *subcutaneous dropsy*, but it is to be avoided as a rule, because of the danger of infection and the slowness with which such wounds heal. If the necessity for relief is urgent, multiple punctures are, as a rule, far preferable in such cases. Whenever scarification is performed it must, of course, be with all aseptic precautions, and in the case of cutaneous scarification the subsequent application of an antiseptic dressing is often a necessity. Scarification as an adjunct to cupping was formerly much practised.

HENRY A. GRIFFIN.

SCILLA.—See SQUILL.

SCILLAIN, SCILLIN, SCILLIPICRIN, SCILLITIN, SCILLITOXIN.—Little is known of these substances obtained from *Urginea Scilla*. *Scillain* is described as a colourless or yellowish glucoside said to be *diuretic*. According to Dr. Cerna, scillain may be given in single doses of $\frac{1}{60}$ of a grain, and in daily amounts of from $\frac{1}{6}$ to $\frac{1}{4}$ of a grain. *Scillin*, according to Merck, is a light-yellow crystalline glucoside. Husemann has found it inert. *Scillipicrin* is a yellowish-white principle, very bitter, and freely soluble in water. It has been found to be *diuretic*, and has been recommended in the treatment of *dropsy*, employed subcutaneously in the dose of from $\frac{1}{2}$ to 1 grain, once a day. *Scillitin* is said to have the same medicinal action as scillipicrin, and in smaller doses, from $\frac{1}{6}$ to $\frac{1}{4}$ a grain. *Scillitoxin* also is diuretic in doses of from $\frac{1}{60}$ to $\frac{1}{30}$ of a grain, and not more than $\frac{1}{4}$ of a grain should be given in the course of twenty-four hours. In the present state of our knowledge of their properties, it is advisable not to use any of these substances in practice.

SCLEROTIC ACID.—This substance, $C_{12}H_{19}NO_9$, obtained from the sclerotium of *Claviceps purpurea* (see ERGOT), seems to differ in medicinal properties, and probably in chemical composition also, according to the method of its preparation. *Dragendorff's sclerotic acid*, according to Merck, is the ergotic acid of Zweifel and the impure ergotic acid of Kobert, a cinnamon-brown, hygroscopic powder, odourless and tasteless, having the *hæmostatic* properties of ergot, but not its ecbolic power. It has been recommended in the treatment of *epilepsy* and *internal hæmorrhages*. It may be given by the mouth or subcutaneously, in amounts not exceeding 5 grains a day. *Podwyssotzki's sclerotic acid* is described by Merck as a light-brown powder having both the *hæmostatic* and *ecbolic* properties of ergot. It may be given in doses of $\frac{1}{4}$ a grain, to the extent of 5 grains in twenty-four hours.

SCOPARII CACUMINA (Br. Ph.).—See SCOPARIUS.

SCOPARIN, $C_{21}H_{22}O_{10}$, obtained from *Cytisus Scoparius* (see SCOPARIUS), is a brownish crystalline powder. It has been thought to be the active *diuretic* and *cathartic* principle of scoparius, but its medicinal properties are not yet well enough known to warrant its employment in practice.

SCOPARIUS (U. S. Ph.), *scoparii cacumina* (Br. Ph.), are the official names for broom-tops, the tops of *Cytisus Scoparius*, indigenous to Europe and cultivated in North America. Scoparius is *diuretic* and *cathartic*; in large doses it is also *emetic*, but should never be used in such amounts. Scoparius is used mostly in the treatment of *dropsy*. The decoction, *decoctum scoparii* (Br. Ph.), may be given in doses of from 2 to 4 fl. oz. The dose of the fluid extract, *extractum scoparii fluidum* (U. S. Ph.), is from 20 to 40 minims; that of the expressed juice, *succus scoparii* (Br. Ph.), is from 1 to 2 fl. drachms. Scoparius contains *sparteine* (*q. v.*).

SCOPOLAMINE, $C_{17}H_{23}NO_3$, is an alkaloid obtained from the roots of the various species of the solanaceous genus *Scopolia*, principally *Scopolia atropoides* and *Scopolia japonica*. It is also found in small quantities in the roots of *Atropa Belladonna*, in the seeds of *Datura Stramonium*, and in *Duboisia myoporoides*. It occurs in permanent transparent crystals, stated to be isomeric with cocaine, atropine, and other members of the tropeine series, which melt into a colourless liquid at a temperature of 59° C. (138·2° F.), and is decomposed by baryta into a crystalline base called scopoline and atropic acid.

The pure alkaloid is insoluble and is not employed in medicine, but is represented by the hydrobromide. This salt can be distinguished with difficulty from the hydrobromide of hyoscine, and the opinion has been advanced that the latter drug, as found in commerce, consists largely of scopolamine hydrobromide. While this is certainly not true of all the hydrobromide of hyoscine on the market, the close resemblance of these drugs may perhaps occasionally cause one to be mistaken or substituted for the other.

Another salt, the hydrochloride, is met with in glassy crystals 3 cm. long by 2 cm. broad.

Sufficient data have not yet been accumulated to enable us to speak positively in regard to the physiological action of the drug. In many ways it closely resembles that of atropine, but is much more prompt and rapid and passes away more quickly. It has been principally observed in the results of instillations of solutions into the conjunctival sac. From 1 to 5 drops of a 0·1 to 0·2-per-cent. solution, thus instilled, will produce a maximum dilatation of the pupil in from ten to sixty minutes, and paralysis of the ciliary muscle proceeds *pari passu* with the pupillary enlargement. This *mydriatic* effect gradually passes away, and disappears in from five to eight days. An effect upon the heart usually becomes manifest within a quarter of an hour after such an instillation, the pulse becoming soft and compressible, while the rate is usually lessened, sometimes to a very marked degree, but is occasionally increased or becomes irregular.

Toxic symptoms have not infrequently been observed. These, as they appear in different degrees of severity, may be given as dryness of the throat, muscular weakness, dizziness, nausea, restlessness or sleepiness, occasionally flushing of the face, dilirium, very rapid and weak pulse, convulsive action of the muscles of the extremities, and paresis of the pharyngeal muscles. No fatal case has yet been reported. The severest case I know of occurred in my clinic at the Manhattan Eye and Ear Hospital while it was under the care of Dr. Kendall. Four instillations of a drop each of a 0·2-per-cent. solution of scopolamine hydrobromide were made into each eye of a young labouring man, at intervals of ten minutes. Fifteen minutes later, toxic symptoms appeared and increased in severity for half an hour. First appeared dizziness, dryness of the throat, nausea and attemps to vomit, flushing of the face which increased to mild cyanosis, decrease in strength of the pulse and increase in its rapidity until it was over 160 a minute, wild dilirium, convulsive action of the muscles of the extremities, and paresis of the pharyngeal muscles. Under treatment with morphine and whisky these symptoms began to abate in two hours. Nausea and dizziness persisted for a day.

Scopolamine is employed principally as a *mydriatic* in ophthalmology, for the purpose of determining the refraction. On account of its rapid action, it would be very desirable if there were less danger of its producing toxic effects. A single drop of a 0·2-per-cent. solution is often sufficient to produce the desired result, and a stronger solution than this should never be used. Solutions of less than half this strength do not seem to be reliable. The danger of poisoning is greatly lessened if not completely avoided by occlusion of the canaliculi by means of pressure while the drug is being employed.

In pathological cases, such as *inflammations of the iris* and *cornea*, scopolamine does not seem to possess any marked advantage over atropine, while the greater tendency to poisoning forms a positive disadvantage. Occasionally it is of use in an attempt to tear away *posterior synechiæ*, or when for other reasons a sharp effect is wanted, on account of the more rapid action of this drug.

[Dr. Charles A. Oliver, of Philadelphia, in a paper read before the Section in Ophthalmology of the College of Physicians (*N. Y. Med. Jour.*, March 21, 1896), said that among quick and active measures, which were so necessary in incipient cases of *plastic iritis* and during the early stages of inflammatory reaction, scopolamine hydrobromide was very important; but where prolonged treatment was necessary, as in many cases of the chronic form of the disease with subacute exacerbations, the good effect did not seem to be lasting. For these reasons he had learned empirically to depend upon the drug where prompt action was necessary, but where more permanent effects were desired he used it alternately with atropine. From the doses in which he had employed the drug, he had never seen any symptoms of poisoning, although in several of the cases in which he had used it freely there had been, at times, giddiness, inco-ordination of movement, and drowsiness. In regard to the question of intraocular tension, he intended to perform a series of experimental researches and to make a relative study of the other mydriatics with which the drug had usually been thought to be associated or, in fact, considered identical.

Dr. William Murrell (*Ann. of Ophthal. and Otol.*, October, 1895) thinks that a 0·1-per-cent. solution of scopolamine hydrochloride is absolutely positive in controlling the accommodation, that in this strength it is non-toxic, and that it is the least troublesome of the mydriatics.

According to two Russian physicians, Dr. W. W. Olderogge and Dr. N. A. Jurmann (*Vratch*, 1895, No. 50; *Therap. Woch.*, January 12, 1896), find that scopolamine hydrobromide is of great value as a *hypnotic* in the *insomnia of the insane*. Administered subcutaneously, in doses varying from 0·003 to 0·015 of a grain, it induced in the majority of the subjects a sleep which lasted from three to ten hours. On awakening, the patients appeared much calmer than before the administration of the drug. This effect was especially pronounced in maniacs, but it was not so marked in acute lypemania. In chronic insanity also its hypnotic action was manifest. In delirium tremens, however, it had no hypnotic action whatever.]—Matthias Lanckton Foster.

SCOPOLEINE, SCOPOLENINE.—This is a poisonous alkaloid obtained by Eykman in the root of *Scopolia japonica*, or "roto," or "Japanese belladonna." Scopoleine is said to be a powerful *mydriatic*.

SCURVY-GRASS.—See Cochlearia.

SCUTELLARIA (U. S. Ph.), is the herb *Scutellaria laterifolia*, or skullcap, which has been employed in medicine, but appears to be practically inert. Several other species of the same genus are found in the United States and are credited with *bitter* and *tonic* properties

The fluid extract, *extractum scutellariæ fluidum* (U. S. Ph.), may be given in doses of a fl. drachm. *Scutellarin* is a precipitate from an alcoholic tincture. It may be given in doses of from 1 to 4 grains.—Russell H. Nevins.

SEA-TANGLE.—See Laminaria.

SEBUM OVILE (Ger. Ph.).—Mutton tallow (see Fats and Tallow). *Sebum salicylatum* (Ger. Ph.) is an ointment consisting of 2 parts of salicylic acid and 98 of mutton tallow.

SECALE CEREALE.—See Rye.

SECALE CORNUTUM (Ger. Ph.).—See Ergot.

SEDATINE.—See Antipyrine.

SEDATIVES are agents employed to produce a calm and quiet condition of mind and body, or of some portion of the body. This is accomplished in morbid conditions by reducing the excessive action of the organ or organs involved, thus lessening functional activity, depressing motility, and diminishing pain. They are naturally divided into several classes in accordance with their action on the morbid conditions in which they are employed.

General sedatives are used to produce sedation of the entire system. They include rest, warm baths, narcotics, anodynes, and hypnotics. These, as well as the individual drugs, are extensively considered under their own heads, so a detailed account of each here is not necessary. The most important and frequently applicable general sedative is rest, by which is meant a removal of the body from any exciting or irritating surroundings to such as conduce to restoration of the equilibrium of its disordered functions. This may with propriety include the rest obtained by a change of scene and occupation, but it is generally used in the more limited sense of cessation from voluntary effort and relaxation of the muscular tissues. The latter is usually best effected by placing the body in a recumbent posture in a quiet room with surroundings which predispose to sleep, or functional rest of the whole system. In conditions of general excitement the ingestion of food into the stomach has a decidedly sedative effect. A warm bath induces muscular relaxation, promotes sedation of the entire system, and is a valuable adjunct in the production of rest.

The drugs which belong to this class act principally through the nervous system, and have been on that account classed by some writers as nervous sedatives. Opium, with most of its alkaloids, particularly morphine, also chloral and the bromides, are the most important members.

Local sedatives are employed to lessen nervous and vascular excitement of a distinct portion of the body and to relieve local irritation, pain, or inflammation. Their effect is due in part to their action on the vessels and tissues, and in part to their action on the terminal filaments of the nerves which supply the portion of the body affected. As usually employed, this term is held to apply to agents which act upon the skin and the accessible mucous membranes, and does not include those which act upon certain of the internal organs. The most prominent agents which belong to this class are cold, in the form of ice, a spray, or an evaporating lotion; heat, either moist or dry; aconite; belladonna; the essential oils; opium; alcohol; chloroform; acetate of lead; and cocaine.

Gastric sedatives are employed to relieve irritability of the stomach shown by pain, nausea, and vomiting. They may act either (*a*) mechanically, by covering the irritated membrane with a bland coating, by diluting the irritating fluid in the stomach and so rendering it innocuous, or by distending the stomach sufficiently to allow the irritated mucous membrane to be bathed with a bland fluid; (*b*) by inducing a contraction of the local blood-vessels so as to relieve the surcharged mucous membrane; (*c*) by a direct effect on the nervous centre which controls the action of the stomach; (*d*) by neutralizing hyperacidity of the gastric fluid; or (*e*) in the manner of a counter-irritant when applied to the integument of the epigastrium.

Bismuth and oxalate of cerium are perhaps the most commonly employed mechanical local sedatives. When there is a persistent attempt to vomit and the stomach contains only a small amount of acrid fluid, as after a debauch or etherization, a large draught of warm water, milk, or other bland fluid will frequently control it at once.

The most powerful local gastric sedative is probably ice swallowed in small pieces. This acts doubtless by both the anæsthetic action of the cold upon the terminal nerve filaments and by inducing a contraction of the local blood-vessels. Alum, nitrate of silver, and other astringents likewise act upon the blood-vessels of the mucous membrane and relieve its congestion.

It is difficult to determine how far the effect of the narcotics, hydrocyanic acid, carbolic acid, and creosote is due to their anæsthetic action on the local nerves, and how far to their action on the nervous centre, but it is generally admitted that it is due largely to the latter.

Alkalies, such as bicarbonate of sodium, are frequently effectual by neutralizing the hyperacidity of the gastric contents which is acting as an irritant.

Counter-irritation in the form of heat or a mustard poultice applied to the epigastrium is a well-known and effective gastric sedative which should not be forgotten. It is more fully described elsewhere.

Spinal sedatives reduce the functional activity of the spinal cord and quiet its abnormal excitability, either by a direct action upon the nerve cells or indirectly by an action upon the circulation of the blood through the cord. Their use is indicated in conditions of irritation or congestion of the spinal cord. The principal ones are gelsemium, physostigma, lobelia, conium, hydrocyanic acid, and bromide and nitrate of potassium. In the administration of these drugs the fact should always be remembered that an overdose may abrogate, for a time at least, the functions of the spinal

cord. Counter-irritation in the form of the electric brush or the actual cautery along the spinal column is also an efficient sedative.

Circulatory sedatives are substances which reduce the circulation, either by diminishing the calibre of the blood-vessels or by rendering the cardiac action slower and less forcible. Those which act to contract the calibre of the vessels are employed mainly to check hæmorrhage and to cut short local inflammation. Cold, by its primary action, best obtained by means of the application of ice or of iced cloths very frequently changed, and heat, by its secondary action, are very powerful agents for this purpose. Ergot, digitalis, hamamelis, opium, salts of lead, zinc, and barium, cocaine, antipyrine, and hydrastis are examples of the drugs which belong to this class.

The circulatory sedatives which render the cardiac action slower and less forcible are useful in *sthenic fevers* and *inflammations*. The principal ones are aconite, veratrum viride, antimonial compounds, pilocarpine, gelsemium, and senega, with its alkaloid, saponin. These all depress the cardiac motor ganglia, the cardiac muscles, or both, while muscarine and pilocarpine stimulate also the inhibitory ganglia. Digitalis frequently acts as a cardiac sedative by stimulation of the vagus centre and of the cardiac muscle, as it thus slows the rate and regulates the rhythm of the heart beats.

Pulmonary sedatives are substances which are employed to relieve dyspnœa or to allay cough. They may be divided into drugs which mechanically protect the affected membrane from further irritation, those which tend to remove the exciting irritant, those which directly allay the irritability of the respiratory centre, and those which act on the terminal fibres of the respiratory nerves in the bronchi and lungs.

Licorice, mucilage, jujube paste, linseed tea, and other like remedies cover the back of the throat with a mucilaginous coating and mechanically relieve a cough when it depends on congestion of the pharynx and trachea. Drugs which diminish congestion of the respiratory passages and so lessen irritation have been considered under expectorants. Most of the pulmonary sedatives either act upon the respiratory centre or obtund the excitability of the terminal nerve filaments, but in many cases it is not yet determined whether a drug acts in one way or the other. Thus, while opium undoubtedly acts principally if not wholly upon the centre, belladonna and stramonium seem to act both upon the centre and upon the terminal filaments. The vapour of certain drugs, such as conium, hydrocyanic acid, stramonium, and tobacco, seems to have a local sedative action, and to diminish local spasm of the bronchioles.

Urinary sedatives render the urine bland, lessen irritability of the bladder, and relieve pain and the desire to micturate. When administered internally, they act through the medium of the urine upon the whole extent of the urinary tract. (See ANTIBLENNORRHAGICS.)

MATTHIAS LANCKTON FOSTER.

SEIDLITZ POWDERS. — The Seidlitz powder, *pulvis effervescens compositus* (U. S. Ph.), *pulvis sodæ tartaratæ effervescens* (Br. Ph.), *pulvis aerophorus laxans* (Ger. Ph.), varies but little in its composition according to the different pharmacopœias. That of the U. S. Ph. is an intimate mixture of about 38 grains of sodium bicarbonate and about 118 grains of potassium and sodium tartrate (Rochelle salt), together with a separate powder of about 35 grains of tartaric acid in fine powder. The two powders are directed to be kept done up in papers of different colours; ordinarily these are blue and white, the blue for the mixture of Rochelle salt and sodium bicarbonate and the white for the tartaric acid. The powders should be kept strictly dry until they are to be used, when the contents of the white paper are to be dissolved in half a glass of water and those of the blue paper in another glass about half full of water. The two solutions are then to be mixed, when brisk effervescence takes place, owing to the action of the tartaric acid on the sodium bicarbonate, whereby carbonic acid is set free. The mixture is to be swallowed while it is still foaming, for it is then not unpleasant to the taste, and, moreover, the action of the carbonic acid on the stomach is that of an agreeable *stimulant* and often serves to check *nausea*. The main action of the Seidlitz powder, however, is that of a *laxative* and *diuretic*. It is most commonly used to overcome temporary *constipation*. Its laxative action may be decidedly heightened by using hot water in making the solutions, which may be flavoured with sugar, lemon-juice, or some syrup. One powder (*i. e.*, the combination of a blue-paper covered and a white-paper covered powder) is the ordinary dose.

SELENIUM.—This element, which in its chemical relations is closely analogous to sulphur, resembles that substance also in medicinal properties, but is more energetic, so that it should not be employed internally until more is known about it. As an external application, Dr. Demontporcelet and Dr. Féré (cited in *Med. and Surg. Reporter*, July 7, 1894) have found that in certain *skin diseases* amorphous selenium yields much better results than sulphur does. They used an ointment made according to the following formula:

℞ Amorphous precipitated selenium.. 30 gr.;
Vaseline..... ..... 1 oz.
M.

SENECIN.—This is a resinlike substance prepared by precipitating a tincture of *Senecio vulgaris* with water. It is employed by the eclectics in *amenorrhœa*, *dysmenorrhœa*, *jaundice*, and *hæmoptysis*, in doses of from 1 to 3 grains. It must not be confounded with *senecine*.

SENECINE.—Under this name a proprietary elixir of *Senecio Jacobœa* is used as an emmenagogue.

SENECIO.—Two species of this genus of the *Compositæ*, tribe *Senecionideæ*, have been used in medicine. Dr. H. S. Purdon, of Belfast, Ireland (*Practitioner*, January, 1882),

speaks well of *Senecio Jacobæa*, the common ragweed, in the treatment of *pruritus* and of *jaundice*, with which itching is often connected. He recommends a Belfast preparation termed *succus senecionis jacobææ*, the dose of which is from 1 fl. drachm. to 1 fl. oz., to be taken early in the morning, with or without a teaspoonful of sulphur. *Senecio vulgaris*, the common groundsel, was formerly employed as an *anthelminthic*, and has of late been employed with success in the treatment of *amenorrhœa* and *dysmenorrhœa* not dependent on lesions of the uterus or its annexa. It has also been used in *hæmoptysis* and *epilepsy*.

SENEGA (U. S. Ph.), *senegæ radix* (Br. Ph.), *radix senegæ* (Ger. Ph.), is the root of *Polygala Senega*, a polygaleous plant indigenous to nearly all parts of the United States east of the Rocky Mountains. It contains senegin (saponin), a fixed oil, a resin, and a small amount of a volatile oil composed of valerianic ether and methyl salicylate. It is chiefly employed as a *stimulating expectorant* in *bronchitis* after the subsidence of acute symptoms and in the stage of resolution of *pneumonia*. It was originally thought to be a remedy for the bite of the rattlesnake, whence its common name of senega, or seneka, snakeroot. It is contra-indicated in cases of gastric or intestinal disturbance, and its use should not be long continued. The dose of the powder is from 10 to 20 grains; that of the fluid extract, *extractum senegæ fluidum* (U. S. Ph.), from 1 to 5 minims; that of the infusion, *infusum senegæ* (Br. Ph.), from 1 to 2 fl. oz.; that of the tincture, *tinctura senegæ* (Br. Ph.), from ½ to 2 fl. drachms; and that of the syrup, *syrupus senegæ* (U. S. Ph.), *sirupus senegæ* (Ger. Ph.), from 1 to 2 fl. drachms.

SENEGIN.—See SAPONIN.

SENEKA.—See SENEGA.

SENNA.—Under this name the U. S. Ph. includes the leaflets of *Cassia acutifolia* and those of *Cassia angustifolia;* the Br. Ph. designates the dried leaflets of the first named species as *senna alexandrina* and those of the other species as *senna indica;* the Ger. Ph. recognises the leaflets of both as *folia sennæ*. Of all *purgatives*, senna is perhaps the one most commonly employed for the simple purpose of overcoming *constipation*. The leaves lose their cathartic properties to a very great extent if they are kept for a long time, and they do not yield them readily to alcohol, so that alcoholic preparations of the drug are in general to be avoided. Senna acts simply by increasing peristalsis, producing soft but not watery evacuations. With some persons it is apt to cause griping, and in most cases it will do so if given in doses rather larger than are needed. It usually operates in from five to seven hours. Pronounced gastric or intestinal inflammation is the only contra-indication to its use. The dose of good senna in powder is from 15 to 30 grains, but it is seldom ordered in that form. The compound infusion, *infusum sennæ compositum* (U. S. Ph., Ger. Ph.), may be given in doses of from ½ to 3 fl. oz. The dose of the fluid extract, *extractum sennæ fluidum* (U. S. Ph.), is from ½ to 1 fl. drachm; that of the tincture, *tinctura sennæ* (Br. Ph.), is from 1 to 4 fl. drachms. The dose of the *syrupus sennæ* of the U. S. Ph. is from 2 to 4 fl. drachms; that of the *syrupus sennæ* of the Br. Ph. and of the *sirupus sennæ* of the Ger. Ph. is from 1 to 4 fl. drachms. Confections and electuaries are held in high favour among the preparations of senna. The *confectio sennæ* of the U. S. Ph. is made with 100 parts of powdered senna, 160 of bruised cassia fistula, 100 of tamarind pulp, 70 of sliced prunes, 120 of bruised figs, 555 of powdered sugar, 5 of oil of coriander, and enough water to make 1,000. The dose is from 1 to 2 drachms. In addition to the ingredients mentioned, the *confectio sennæ* of the Br. Ph. contains extract of licorice; the dose is the same as that of the U. S. preparation. The *electuarium e senna* of the Ger. Ph. is made from 1 part of powdered senna, 4 parts of syrup, and 5 parts of tamarind pulp; the dose is from 2 to 4 drachms. The compound mixture of senna, or black draught, *mistura sennæ composita* (Br. Ph.), is made with 4 parts of magnesium sulphate, 1 fl. part of liquid extract of licorice, 2½ fl. parts of tincture of senna, 1½ fl. part of compound tincture of cardamom, and 15 fl. parts of infusion of senna. The dose is from 1 to 1½ fl. oz. Senna is the chief purgative ingredient of the compound licorice powder (see vol. i, page 581).

SEPTENTRIONALINE.—According to Professor Virgil Coblentz (*Newer Remedies*, New York, 1896), this is an alkaloid obtained from *Aconitum septentrionale*, which has been recommended (in doses not stated) in the treatment of *strychnine poisoning*, *tetanus*, and *rabies*.

SÉQUARDINE.—This name has been given to two different medicinal substances: 1. The sterilized testicle extract recommended by the late Dr. Brown-Séquard (see ANIMAL EXTRACTS AND JUICES). 2. A mixture of various glycerophosphates proposed as a substitute for testicle juice.

SERO-THERAPY.—See SERUM THERAPY.

SERPENTARIA (U. S. Ph.), *serpentariæ rhizoma* (Br. Ph.), Virginia snakeroot, according to the U. S. Ph., is the dried rhizome and rootlets of *Aristolochia Serpentaria* and *Aristolochia reticulata*. The Br. Ph. recognises only the first of these two plants. Serpentaria is a mild *tonic* and is occasionally used as a remedy for *intermittent fever*, given during the chill, in a dose of from 8 to 20 grains; also in *dyspepsia*. The dose of the infusion, *infusum serpentariæ* (Br. Ph.), is from 1 to 2 fl. oz.; that of the tincture, *tinctura serpentariæ* (U. S. Ph., Br. Ph.), from ½ to 2 fl. drachms; that of the fluid extract, *extractum serpentariæ fluidum* (U. S. Ph.), from 15 to 30 minims.

SERPYLLUM, *herba serpylli* (Ger. Ph.). —Wild thyme (see under THYME).

SERUM.—This constituent of the blood seems, even in its normal condition—that is to say, when its constitution has not been modified by the action of any toxine—to be possessed of an antitoxic power, and probably this assists

in the prophylactic and curative action of the antitoxine treatment. Indeed, the normal serum of certain animals has been used with alleged benefit in the treatment of disease. For its use in *cancer*, see under SERUM TREATMENT. In the *Medical Record* for July 11, 1896, Dr. J. A. Dunwody, of Cripple Creek, Colorado, reports four cases of *pulmonary tuberculosis*, including that of himself, in which subcutaneous injections of horse serum were used. In three of them much benefit seemed to ensue. Dr. Dunwody gives the following account of his own case: He was attacked when he was thirty years old. On July 26, 1895, a physical examination showed the upper two thirds of the left lung to be infiltrated; numerous moist râles could be heard throughout this portion, and there was expectoration of a muco-purulent character, about two ounces during the twenty-four hours. His weight was a hundred and twenty-five pounds. Microscopic examination showed tubercle bacilli. The range of temperature was from 99° to 100° F., and this continued until August 2d, when he was attacked with acute pleurisy on the left side, which confined him to bed for ten days. The temperature ranged then from 100° to 102·5° for a week, after which time it was from 99° to 100° until September 18th, when it became 98·5° F. The injections of serum were begun on July 26, 1895, with 10 millimetres and rapidly increased to 45 millimetres, and were then reduced to 30 millimetres, which quantity was maintained continuously, notwithstanding the attack of pleurisy, until December 24th, at which time a small abscess was produced, owing to the want of proper care by the physician giving the injection. His weight at this time had increased to a hundred and forty-three pounds; the expectoration had nearly ceased so that there was not enough for microscopical examination. Physical examination revealed the absence of all râles; there was clear vesicular respiration throughout the affected portion of the lung, though it was somewhat weak in character. The right lung was not affected at all. On March 24, 1896, he was attacked with influenza, and during the time it lasted his weight was reduced to a hundred and thirty-four pounds and the cough returned for a short while, with loss of appetite, etc. On April 13th he resumed the daily injection of 30 millimetres of serum, with a resulting increase of weight of two pounds and the cessation of the cough at the time of the report, April 23d. He adds: "I have used no other treatment at all—the injections of serum alone. This point in my case proves conclusively the great mistake of stopping the use of the serum too soon, or before the lung tissue has been restored to its full strength and vitality."

Dr. O. Reinach, of Munich (*Münchener med. Woch.*, May 5, 1896), reports on the use of cow's serum in the *summer diarrhœa of children*. In fifteen cases of *cholera infantum* he employed subcutaneous injections of the serum in doses of from 10 to 20 cubic centimetres. Four of the patients died; two had a concomitant broncho-pneumonia, and two a follicular gastro-enteritis of long standing. The effect of the injections manifested itself ordinarily in from six to eight hours after the administration of the serum, and from that time the temperature gradually rose, the extremities became warm, the cyanosis gave place to a rosy tint of the skin, and the diarrhœa was arrested. This condition generally continued on the following day, and recovery usually occurred after one injection only. In some cases, however, a second injection was necessary in order to maintain the good results which were obtained by the first one. Besides these injections, rice water was given. The author states that, from a nutritive point of view, twenty cubic centimetres of assimilable serum are equivalent to five ounces of cow's milk, or to an ounce and a half of the mother's milk. At the time of making the report, Dr. Reinach was continuing the serum treatment, but was using horse serum.

Antistreptococcic serum.—See under SERUM TREATMENT.

Artificial serum was used as long ago as in 1855 by the late Dr. Edmond R. Peaslee in the performance of ovariotomy. It was composed of 4 drachms of sodium chloride, 6 drachms of white of egg, and 4 pints of water. "It is intended," says Dr. Peaslee, "to imitate the natural secretion of the peritonæum, and is kept at a blood-heat, and used to thoroughly moisten the operator's hands before they are introduced into the peritoneal cavity."

M. Mengus (*Indépendance médicale*, July 22, 1896; *Revue internationale de médecine et de chirurgie*, September 10, 1896) relates a case of *hydrocele* of the tunica vaginalis testis that had relapsed after the employment of an injection of tincture of iodine. It was cured by injecting a boiled and filtered 0·7-per-cent. solution of sodium chloride at the temperature of 104° F. He relates also a case of *ascites* in a patient with heart disease. Paracentesis had had to be performed six times in the course of five months, and the man was becoming cachectic. The seventh puncture was followed by the injection of about a quart of the same solution at the same temperature. After massage, about three quarters of the amount was withdrawn. The patient regained his general health, and at the time of the report, three months afterward, no further effusion had taken place.

Internally, artificial serum has been used as a *tonic*, especially in cases of *neurasthenia*, and as a *restorative* in cases of *acute anæmia from hæmorrhage;* it is injected subcutaneously or into a vein by infusion (see under TRANSFUSION). The following is Sir Benjamin Ward Richardson's formula:

White of egg	1 oz.;
Sodium chloride	1 drachm;
Sodium phosphate	20 grains;
Clarified animal fat	1 oz.;
Glycerin	2 oz.;
Water, enough to make a pint.	

Hayem's formula is as follows:

Sodium sulphate	10 parts;
Pure sodium chloride	5 "
Sterilized distilled water	1,000 "

This solution, heated to the normal temperature of the blood, is injected into the internal saphenous vein, to the amount of 2 quarts, in cases of *Asiatic cholera*.

Huchard's formula is as follows:

Pure carbolic acid	7½ grains;
Sodium chloride.....	30 "
Sodium sulphate	60 "
Sodium phosphate.....	120 "
Distilled water.....	25 drachms.

Thirty minims of Huchard's solution are injected subcutaneously three times a week.

Chéron's solution is prepared according to the following formula:

Pure carbolic acid.....	15 grains;
Sodium chloride	30 "
Sodium sulphate	120 "
Sodium phosphate.....	60 "
Distilled water.....	25 drachms.

In cases of *neurasthenia* of moderate severity, from 75 to 150 minims of Chéron's solution are injected subcutaneously, behind the trochanter major, every second or third day; in grave cases, every day.

At a meeting of the Paris Academy of Medicine held on June 30, 1896 (*Gazette hebdomadaire de médecine et de chirurgie*, July 2, 1896), several speakers mentioned the good effects of subcutaneous and intravenous injections of artificial serum in *septicæmia after operations*, in *anæmia*, and in *shock*. The discussion shows how unsettled professional opinion is as to the precise value of injections of artificial serum and on the question of their being dangerous when thrown into a vein, but, on the whole, as M. Péan puts it, there was general agreement as to the usefulness of subcutaneous injections and the precaution with which intravenous injections should be administered.

M. Pozzi made a report on M. Duret's work in regard to the treatment of *septicæmia following operations* by means of these injections. He showed that the practice was widespread in the hospitals of Paris, and said he had concluded that this method of treatment was sometimes very efficacious, and one to be recommended. He gave the preference to subcutaneous injections of a solution of sea salt in the proportion of seven to a thousand. These injections, he said, favoured phagocytosis and diuresis, which exerted a favourable influence in certain forms of septicæmia and prevented a fatal result. M. Championnière had also obtained good results in the treatment of *anæmia* and *shock*, but not in septicæmia. He was inclined to doubt some of the statements that had been made, and he thought intravenous injections were not harmless, and that, at the present day, there was danger of the method being abused. M. Dumontpallier thought that injections of ether were sufficient, and said he would not allow any surgeon to practice intravenous injections on him. M. Pinard stated that he had seen recovery follow subcutaneous injections in seventeen women whose condition had been such that, before the employment of this method, death would probably have resulted. M. Tarnier also had obtained good results in cases in which by the old method of treatment death would certainly have resulted. M. Reclus stated that he had experimented with intravenous injections on a boy who had *rabies*. The treatment had not been begun until two weeks after the boy had been bitten, but an injection of nearly 5 ounces had seemed to quiet the patient, who died, however, two hours later.

Subsequently, at a meeting of the Société de biologie (*Journal des praticiens*, July 25, 1896), M. Bosc and M. Vedel presented the following conclusions: 1. Large intravenous injections of a simple saline solution are not toxic, in spite of their quantity and the rapidity with which they are given—from 45 to 83 cubic centimetres a minute. 2. The physiological effects of these large injections are not in proportion to the temperature of the solution and the rapidity with which the injection is made. 3. These injections produce an abundant diuresis, which occurs half an hour after the solution has been injected; there is no elevation of the blood-pressure, and there is no albuminuria; but there is acceleration of the heart with an elevation of the central and peripheral temperature which resembles that of fever. 4. A 0·7-per-cent. solution of sodium chloride is preferable to a 0·5-per-cent. solution. 5. Large intravenous injections of compound saline solution (chloride and sulphate of sodium) are deprived of their harmful effects under the same conditions as those of the simple saline solution. 6. There is no difference between the effects of these two solutions. 7. The addition of sodium sulphate to the sodium chloride does not seem to be useful; it seems rather to be prejudicial to globular preservation, according to Mayet. 8. During a series of injections each individual injection has the same effects; they are equally harmless. 9. Fasting animals appear to be more susceptible than others to large intravenous injections, but, in spite of the appearance of grave symptoms during the administration of the injections, even apparent death, the animals rapidly return to their normal condition. 10. The simple saline solution seems to be the preferable solution for intravenous injections; it produces the minimum of harmful effects and the maximum of physiological effects.

In addition to its restorative action in *shock* and *acute anæmia from loss of blood*, artificial serum has been thought to act as a *hæmostatic*.

Dr. L. Le Clerc (*Semaine médicale; Revue internationale de médecine et de chirurgie*, June 10, 1896) relates the case of a woman who lost a great deal of blood during her third pregnancy and with its termination in abortion. Neither curetting of the uterus with subsequent tamponing nor the use of drugs served to check the hæmorrhage, and her condition became critical, as was shown by her shallow breathing and the imperceptibility of her pulse. In this emergency the author injected about 40 cubic centimetres of artificial serum (a solution of 1½ drachm of sodium chloride and 2 drachms of sodium sulphate in a quart of distilled water) into the basilic vein and, in addition, rather more than 8 oz. of the same solution under the skin of the thigh. The activity of the heart and of the respiration was soon regained, the uterine hæmorrhage ceased

definitively, and the patient recovered with striking rapidity. The author accounts for the hæmostatic effect of the injections by their stimulant action on the vaso-constrictor nerves.

M. André Claisse (*Gazette médicale de Paris*, September 26, 1896; *New York Medical Journal*, October 31, 1896) also has used artificial serum in acute anæmia from hæmorrhage, in the form of one of the following solutions:

1. Distilled water..... 31 ounces;
   Sodium chloride..... 105 grains.
2. Distilled water..... 31 ounces;
   Sodium chloride, Sodium sulphate, each. 105 grains.

The solution should be clear and without any foreign substance; it may be sterilized by being submitted to a temperature of 248° F. or to a boiling of twenty minutes' duration. It should be injected at the temperature of the body, and, as it loses several degrees during manipulation, it should be kept in a funnel at a temperature of about 104°. (See also under TRANSFUSION.)

M. Sapelier (*Revue internationale de médecine et de chirurgie*, August 10, 1896) recommends injections of artificial serum in *exanthematous typhus*. He says they may be employed for patients of all ages and conditions at any stage of the disease. High fever is the best indication for the employment of the serum in typhus, and the liquid should be at a temperature of 86° F. at least. The advantage of this treatment over that with cold baths, says M. Sapelier, lies in a direct lowering of the temperature which lasts from twelve to fourteen hours on an average. In regard to the effect on the urine, it is so striking, he says, that one may tell by the urine alone whether the patient is undergoing the serum treatment or not. In those who are under any other treatment the urine is scanty, and all the scantier in the graver cases, dark-coloured, cloudy, very dense, and albuminous, with a considerable diminution of the amount of urea excreted, and it is not until late in the disease that there are critical discharges of clear, limpid urine free from albumin, but still charged with toxic products. On the other hand, under the serum treatment he has seen the urine, from the very beginning of the course, passed in quantities as great as from four to five quarts in twenty-four hours and clear and limpid, and that in spite of the fact that for half the day the temperature was elevated; moreover, the excretion of urea was far different in amount from that seen in cases treated on the old plan, the albumin rapidly diminished and soon disappeared altogether, and the toxines were readily and rapidly eliminated, indeed, as fast as they were produced, so that the patients were the better able to resist the disease, and consequently the deaths were fewer. In twelve grave cases subjected to the serum treatment, in ten of which the patients were aged—a fact that was much against the chance of their recovery—a fatal result occurred in only six, so that it is upon grave cases alone that M. Sapelier grounds his statement as to the reduction of the mortality from eighty-five in the aged and eighty as the average of the epidemic of 1893 to fifty.

Dr. Bassi (*Gazzetta degli ospedali*, June 6, 1896; *British Medical Journal*, July 18, 1896) reports six cases of severe *acute pneumonia* treated after the method of Galvagni—that is, by intravenous injections of a solution of chloride and bicarbonate of sodium. In each case the pneumonia was double and of a grave type; of the six patients, five recovered and one died, and at the necropsy double bronchopneumonia, right lobar pneumonia, and acute nephritis in addition to an old chronic nephritis, also some mitral stenosis were found. With regard to the other cases, the author believes the treatment was of material service. The best time to give the injections, he thinks, is about a day before the expected crisis, or when the pulse becomes intermittent, or, in fact, upon any grave alteration in the condition of the patient. A small preliminary bleeding is useful. Whether the treatment acts by preventing coagulation of the blood, by oxygenating (through the incision) the venous walls and acting in a reflex way on the circulation, or in some less-known manner, the author is unable to say, but, from his clinical experience in its use, he feels justified in strongly recommending it for further trial. In a footnote he refers to two other cases in which it was tried by him with success.

Dr. Brodier (*Médecine moderne*, June 13, 1896; *Therapeutic Gazette*, November, 1896) reports the case of a patient, aged thirty-one years, who was brought to the hospital suffering from *asphyxia due to inhalation of oxide of carbon* during the previous night. He was comatose, and the reflexes were lost. Altogether his condition was exceedingly grave, the respirations being 44 a minute and the inspirations short and abrupt, while the expirations were prolonged. The stertor was intense, and finally the respirations became 52 a minute. There was nystagmus, the pulse was rapid and feeble, and the temperature was normal. The condition of the patient was so grave that any therapeutic measures were considered useless, but nevertheless inhalations of oxygen and injections of ether were given. After six hours he was no better, the coma persisted, and the respirations, while less rapid, were still stertorous; nystagmus was still present. Under these circumstances a quart of artificial salt solution was injected, at a temperature a little above that of the body, into the median cephalic vein, the operation lasting twenty minutes. A quarter of an hour afterward the patient was seized with a violent chill, and twice vomited bilious-looking material, and at the same time broke out into an abundant sweat. Two hours afterward, as the symptoms did not improve, another injection of saline solution was given. On catheterism, nearly a pint of clear liquid, which contained a small quantity of albumin and sugar, was obtained. In four hours after the man was brought into the hospital the trismus had ceased, the respirations were calm and regular, and catheterism obtained nearly a quart of urine. The patient returned to consciousness, and complained of violent frontal headache and great anorexia. The retention

of urine persisted, and there were fibrillary twitchings in the lower extremities. The glycosuria did not continue, but the albuminuria lasted for eight days. The patient left the hospital completely cured in twelve days after his entrance. Brodier alludes to the experiments of Moromarco in 1892, which were made after the proposal of Kühne, that saline injections should be used in all forms of grave poisoning, and adds that cases have been reported by Schreiber, Bergmann, and Fraentzel, of the advantage of this method of treatment.

Cf. *Sodium phosphate*, under PHOSPHORUS (vol. ii, page 79).

SERUM LACTIS.—See WHEY.

SERUM PASTE.—According to Professor Coblentz (*Newer Remedies*, New York, 1896), this is fresh serum from ox blood, thoroughly mixed with 25 per cent. of zinc oxide and sterilized at a temperature of 158° F. in a thermostat. "When painted over denuded or diseased surfaces," he says, "it dries readily, leaving a film which may be readily removed by washing with water."

SERUM POWDER.—Professor Coblentz (*op. cit.*) says that this is a mixture of fresh ox-blood serum and 25 per cent. of zinc oxide spread on glass plates and dried, then finely powdered, and sterilized at a temperature of 212° F. It has been recommended as an *antiseptic* dusting powder to be used alone or mixed with some other antiseptic.

SERUM SUBLIMATE.—This is dried blood serum containing 10 per cent. of corrosive sublimate, used in the preparation of antiseptic gauze.

SERUM THERAPY, SERUM TREATMENT.—The meaning of the terms toxine, antitoxine, and therapy with immunized serum is best understood by consideration of the present state of the question of immunity and the very practical deductions therefrom.

We know that there are certain diseases, such as anthrax, diphtheria, and others, which are caused by specific micro-organisms. Each of these micro-organisms gives off a special toxine. The anthrax bacillus and the diphtheria bacillus, for example, do not themselves produce the effects we group under the titles anthrax and diphtheria; the toxines thrown off by the bacilli are the immediate causes of these diseases. When a man has received the toxine of a pathogenic bacterium into his body the physician does not attack the disease directly; he sustains the patient until the human organism has itself produced an antidote for the poison—an antitoxine for the toxine. When the antitoxine has been made in quantity sufficient to offset the amount of toxine in the system, recovery begins. Immense labour has been expended in isolating various toxines, but the present results are very unsatisfactory. Hardly anything has been ascertained in regard to antitoxines, except that they exist. Leaving the bacterium in a culture medium, or filtering it out, we can precipitate a substance which gives the reactions of albumose and of an organic acid or alkali—this is, the toxine. Beyond this, and the fact that some, at least, are enzymes, little is known. That these precipitated substances are really the specific toxines of the bacteria from which they are derived, we prove by the effects, also specific, which they produce upon animals inoculated with them.

When a human being or one of the lower animals has enough antitoxine in his or its blood serum to neutralize that quantity of the toxine of a pathogenic bacterium which, if not controlled, would cause disease or death, the man or animal is said to be "immune" against the poison of that micro-organism. In our knowledge of immunity, we are still in the stage of theory—rather in that stage where there are almost as many theories as there are writers upon the subject. Buchner held the "theory of the bactericidal power of body humours" to explain recovery and immunity. He supposed that the blood plasma, the liquid of exudates, and other body humours killed bacteria, and that afterward the leucocytes removed the dead micro-organisms. He himself gave no facts to prove his assertions. In 1894 he modified his theory, and said that the leucocytes gathered in inflammation produced alexines which destroyed bacteria. This seems to be substantially the theory advanced by Hankin, Kanthack, and Hardy, except that they maintained that the alexines were produced by eosinophile leucocytes, an assertion refuted by Mesnil. Chauveau, in 1880, formulated the "retention theory"—*i. e.*, the theory that immunity exists by virtue of some bacterial product retained or deposited in the tissues. In the same year Pasteur proposed the "exhaustion theory"—that immunity is an effect caused by abstraction from the tissues of the specific pabulum of a micro-organism. Both these hypotheses are untenable. The theory most widely accepted at present to explain immunity is called the "theory of cell excitation." The toxine of the bacterium stimulates the body cells to the production of an antitoxine. It seems to be established that phagocytosis, first indicated by Sternberg and four years later developed by Metchnikoff, to some extent assists in the removal of bacteria, but probably the presence of the antitoxine enables the animal organism to eject the foreign substances by means more general than phagocytosis.

Immunity is acquired naturally or artificially. Natural immunity is seen after convalescence from a bacterial disease. Artificial immunity is produced by injecting into the animal's body at intervals graded quantities of a medium holding in solution the toxine of a bacterium. The medium is usually freed from the micro-organism itself by filtration. At first a certain small quantity of this toxine, of known strength, unmixed with any attenuating chemical, is injected into the animal, or the toxine is attenuated with a drug—say, iodine trichloride—and, in both methods, it is left in the circulation for a number of days. In getting diphtheria antitoxine Roux does not attenuate with drugs, and the Germans also have abandoned this method. The small quantity

first injected does not usually cause the animal serious inconvenience, but it is large enough to excite the body cells into the formation of an amount of antitoxine sufficient to neutralize the toxine placed in the circulation. At the second injection a larger quantity of toxine is given. The antitoxine already formed neutralizes this larger quantity in part, and the freshly stimulated cells again make more antitoxine to neutralize the remainder of the toxine. Thus the process goes on until there is enough antitoxine in the circulating serum to render harmless a lethal dose of the poison. The animal is then said to be "immune."

"Immunized" serum from this animal may be injected into the circulation of another animal suffering from the specific disease naturally produced by the toxine used in the immunization, and this second animal is almost immediately rendered "immune," not being obliged to slowly build up the antitoxine. Behring calls the state of the first animal "active artificial immunity," that of the second, "passive artificial immunity."

There is immunization, or partial immunization, which may be called indirect, as when the virus of vaccinia "immunizes" wholly or in part against variola, or erysipelas counteracts the poison of infectious pneumonia, an effect which seems to have happened in some cases. In vaccinia and variola no specific micro-organism has been demonstrated, and it is not yet established whether direct immunization against the latter disease is possible, but the serum from calves which have for a time been subjected to the action of vaccinia virus has been tried upon *small-pox* patients by Dr. J. J. Kinyoun, of the Marine-Hospital Service. The experimentation up to the present time has been limited to very few cases, but the results obtained have been remarkable. Calmette, of Paris, has also applied with success the principles of direct immunization to protect animals against the *venom of the cobra*. He is now working with the *venom of the American rattlesnake*, a poison remarkably similar to the toxine of diphtheria, and he will probably succeed. Serum "immunized" against snake venom must be applied within an hour or two after the bite, and this necessity will limit its practical value. Pasteur's immunization against *rabies* and *anthrax* are applications of like principles; the body cells are supposed to be stimulated to form antitoxines, but in these two cases a mild attack of the disease itself is induced, and the toxine and antitoxine are evolved simultaneously in the animal organism. Sanarelli has studied the immunization of animals against the vibrio of Metchnikoff, and he and others have worked in the same way with the bacillus of typhoid fever. G. and F. Klemperer, Issaef, and Foa have experimented with the diplococcus of pneumonia, and Pfeiffer, Wassermann, and Sobernheim with cholera. George F. Nuttall, an American, first demonstrated that the bactericidal virtue in the animal organism lay in the blood serum. Two years later Behring and Kitasato rendered animals "immune" to tetanus, and at the same time Ogata and Jasuhara discovered that there existed something in the serum of animals "immune" to anthrax which would protect other animals. Thus the methods of immunization have grown more perfect until the results are astonishing. A detailed account of the process followed in immunization against diphtheria will be given here, because this is almost perfectly elaborated and it is the most valuable in its application. These details will make clear what a process of immunization signifies.

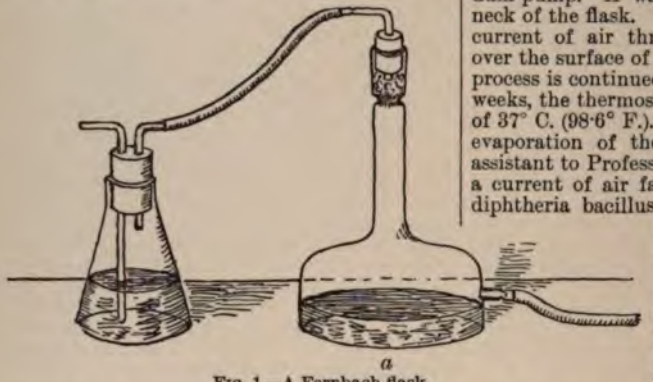
To Behring should be given the honour of first elaborating a method for immunizing animals against diphtheria. Roux's method, which has essential differences, is more practical. The immunizing serum is obtained in about three months by the French method, whereas with the German methods from six to eight months are required. Dr. J. J. Kinyoun, passed assistant surgeon in the United States Marine-Hospital Service, published a remarkable paper in the *Abstract of Sanitary Reports* (No. 51, vol. ix, December 21, 1894) giving a complete account of the German and French methods of immunizing against diphtheria, and the results obtained. This knowledge was procured directly from Professor Roux, Professor Behring, and Dr. Aronson, and the paper, together with information given by Dr. Kinyoun personally, will be used in describing the manufacture and employment of the serum.

The animal now chosen for immunization, after trial of many others, is the horse. A horse should not be more than nine years of age, and it should be constitutionally sound. If it has defects which are merely local, these do not lessen its worth. A high-bred horse does not bear the injections well. During the process of the immunization the animal needs gentle exercise, but it must not be put to work, and this holds true while the state of immunization is kept up.

When a horse has been selected, mallein is injected to test for latent glanders. The temperature is taken in the rectum every two hours for two days, and if there is no elevation of the bodily heat, no œdema, anorexia, or sluggishness, the animal is considered free from glanders. Professor Klebs, in a recent article in an American medical journal, says the mallein test is not reliable, especially in latent cases of glanders. De Schweinitz, of Washington, in a series of 1,000 cases, found it somewhat unsatisfactory in only two. It is especially valuable in latent cases, and, even if it were not reliable, the serum is filtered before it is used upon the human subject, and there is no danger of transmitting glanders. After the mallein test the horse is permitted to rest for a day or two, and then an injection of tuberculin is given to test for tuberculosis. The temperature is taken, and the general condition is noted as during the mallein test. After another period of rest, a day or two, the hypodermic or intravenous injections of the diphtheria toxine are begun. The German serum is as good as the French, but the German methods of preparing it are so slow that only the French method will be given here.

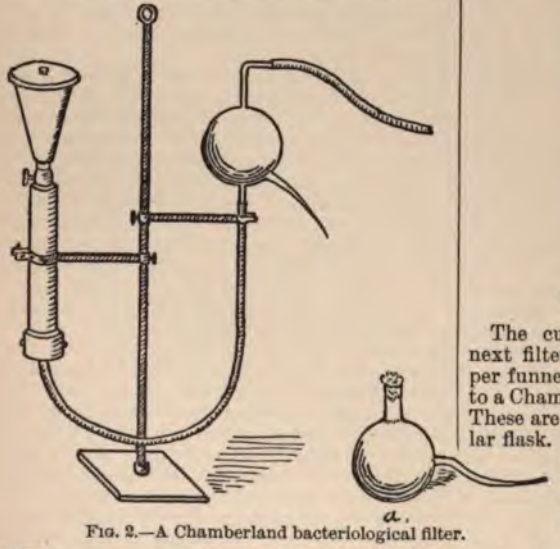
The preparation of the toxine is one of the

most arduous stages in the process. A flask containing alkaline 1-per-cent. peptone broth is inoculated with a looped needle from a culture of diphtheria bacilli strong enough to kill a 500-gramme guinea-pig in at least thirty-six hours. The flask is left in the thermostat for twenty-four hours at 36° C. (96·8° F.), that the bacilli may begin to multiply. This stock growth is then used to inoculate broth in Fernbach flasks, in which the toxine is to be formed. The Fernbach flask (*a*, Fig. 1) has a neck, a foot in length, constricted to hold a cotton stopper, and the flat-bottomed body is four inches high and eight inches in diameter; one inch from the bottom there is a three-inch tube inserted, which is also constricted for a cotton plug. It is an improvement to have this side-tube bent at a right angle to prevent spilling of the culture. The Fernbach flasks are filled up to near the side-tube with alkaline peptone bouillon and sterilized in steam; after this they are inoculated, each with about 40 c. cm. of the stock growth of bacilli, and are left in the thermostat twenty-four hours at 37° C. (98·6° F.), that the growth may begin. Then rubber tubing is passed through holes in the thermostat and connects the side-tube of the Fernbach flask with an ordinary water vacuum-pump. A wash-bottle is joined to the neck of the flask. The vacuum-pump draws a current of air through the wash-bottle and over the surface of the culture medium. This process is continued uninterruptedly for three weeks, the thermostat always at a temperature of 37° C. (98·6° F.). The wash-bottle prevents evaporation of the bouillon. Dr. Fernbach, assistant to Professor Duclaux, discovered that a current of air favoured the growth of the diphtheria bacillus, possibly by removing inhibitory volatile products and by supplying oxygen. If bacteria are placed under circumstances unfavourable to growth they give off but little toxine, but when the medium and gases are supplied adequately, these micro-organisms take on a rapid growth which ends in proliferation and abundant production of toxine. At the end of three or four weeks the bouillon in the Fernbach flasks contains masses of partially or wholly disintegrated bacilli and it is thoroughly impregnated with toxine.



a

FIG. 1.—A Fernbach flask.



a

FIG. 2.—A Chamberland bacteriological filter.

FIG. 3.—A Martin toxine bottle.

The cultures in the Fernbach flasks are next filtered. A sixty-degree 500-c. cm. copper funnel, containing filter paper, is attached to a Chamberland bacteriological filter (Fig. 2). These are joined by rubber tubing to a globular flask. The flask has a filling tube at the bottom and a tube at the top which is to be connected with the water vacuum-pump. At the side of the flask there is a sealed tube which may be broken open when the contents of the flask are to be drawn off into the cotton-stopped 250-c. cm. storage bottles (*a*, Fig. 2), which also have sealed side-tubes.

Everything being sterile, the culture is

poured from the Fernbach flask into the filter and the vacuum-pump rapidly aspirates the toxine in solution over to the globular flask, leaving all the bacilli behind. When the globular flask is full, the drainage-tube at the side is nipped and the toxine drawn into the sterile storage bottles. The virulence of the toxine is then tested, and if 0·1 c. cm. will kill a 500-gramme guinea-pig within twenty-four hours the toxine is considered most suitable for effecting immunization.

The horse, which has already been tested for glanders and tuberculosis, is prepared for inoculation by having a spot of about the size of a man's palm on the shoulder clipped bare of hair and disinfected. The toxine is carried in a Martin toxine bottle (Fig. 3). This is a bottle arranged like a wash-bottle. The air-vent is stopped with cotton and the tube that runs into the toxine solution, and through which the toxine is sucked into the injection syringe, ends in a small rubber tube which fits the nozzle of this syringe. There is a pinch-cock on the rubber, and, of course, the entire apparatus is sterile. The Germans use the Koch injection syringe. The Roux syringe has a glass barrel with rubber washers and metal fittings, and the piston-head is shaped like a spool, the flanges of which are rubber and the body of which is metal (Fig. 4). This piston fits snugly, and it can easily be kept clean. It is lubricated with sterile talc. The needles are of platino-iridium, a composition nearly as rigid and elastic as steel, and one which may be sterilized in the flame.

Fig. 4.—A Roux syringe.

For the first injection 0·5 c. cm. of toxine is given. This toxine is not attenuated with any drug, and it is selected from a specimen 0·1 c. cm. of which will kill a 500-gramme guinea-pig in twenty-four hours. The injections are always made under the skin, not into a muscle. The horse's temperature is taken in the rectum twice a day; its respiration must be watched, and signs of œdema, anorexia, or any abnormal condition are noted. On some horses even the initial injection has a bad general effect, and usually there is considerable local and general reaction—œdema and inflammation at the spot of injection, and a rise of one or two degrees C. in temperature. There may be anorexia, also muscular spasm or twitching. On the eighth day 1 c. cm. is given, and on the fourteenth day 1·5 c. cm. If the horse should become very ill after any of these doses, a small quantity of Gram's solution is added to the toxine (1 part of Gram's solution to 2 parts of toxine) to attenuate it before injection. After the second dose, the animal usually bears the toxine with little or no discomfort. It is impossible to give a universal rule for the quantity used and the intervals to be observed in the injections. The general and local reactions must always be considered, and a new injection should not be attempted till these subside. A general plan, subject to considerable change, of course, might be presented as follows:

First day, 0·5 c. cm.
Eighth day, 1 c. cm.
Fourteenth day, 1·5 c. cm.
Twentieth day, 2 c. cm.
Twenty-eighth day, 3 c. cm.
Thirty-third day, 5 c. cm.
Thirty-eighth day, 8 c. cm.
Forty-third day, 10 c. cm.
Forty-seventh day, 20 c. cm.
Fifty-first day, 30 c. cm.
Fifty-sixth day, 50 c. cm.
Sixty-second day, 50 c. cm.
Sixty-eighth day, 60 c. cm.
Seventy-fourth day, 100 c. cm.
Eightieth day, 250 c. cm.
Eighty-eighth day, 250 c. cm.

Usually, after two months the toxine causes only local œdema, which may be very large, but this subsides within a day or two. Near the end of the third month the horse's serum is fit for use. Blood is drawn from the jugular vein by means of a trocar and cannula. The trocar should be about 8 inches in length, its cannula about 5 inches long and nearly $\frac{3}{16}$ of an inch in diameter. The cannula has a stopcock on it which is used when the slow intravenous method of injecting the toxine is followed. A short metal tube, which fits into the cannula after the trocar has been withdrawn, is fastened to a rubber tube a foot and a half in length; and into the other end of the rubber tube is inserted a glass tube about 4 inches long. Wide-mouthed 2,500-c. cm. bottles are used to catch the blood. A piece of paper is tied over the mouth of each bottle and a paper hood is placed upon this. The trocar and tubes are sterilized, and then kept in a 5-per-cent. carbolic-acid solution. The blood bottles are sterilized separately. A spot over the horse's jugular vein is clipped bare of hair, the animal is blindfolded, and a twitch is put upon its upper lip. The bared spot is disinfected with a 5-per-cent. carbolic-acid solution. A cut is made through the skin, the jugular is compressed by the hand to make it prominent, then the trocar is pushed into the vein, the point downward. An assistant removes the paper hood on the blood bottle, leaving the paper cover, through which he plunges the glass end-tube. Then the trocar is withdrawn and the rubber tube is attached to the cannula. From 6 to 8 litres (nearly 2 gallons) of blood are drawn from a horse at one bleeding. The blood is allowed to coagulate, and then the bottles are put into an ice-chest. Within twenty-four hours the serum will have separated, and from $2\frac{1}{2}$ to 3 litres are obtained from the 6 litres of blood. This serum is drawn off with sterile Pasteur filling pipettes and put into storage bottles. It may be first run through a Chamberland filter. To kill any organisms which may have dropped into it, a bit of gum camphor is put into each storage bottle. The camphor is first lighted to sterilize its surface, the flame is extinguished, and the piece is dropped into the serum. The serum will keep for two or three months without deterioration, if not exposed to light or variations of tem-

perature. It may be desiccated *in vacuo*, but it then loses strength, and it causes irritation when injected subcutaneously.

After the serum is separated from the coagulum its strength is tested, and this test must be repeated after each bleeding. The French choose a young guinea-pig, as near 500 grammes in weight as possible, and weigh it. They inject 1 c. cm. of the serum just obtained from the horse, and twelve hours later 0·3 c. cm. of a toxine which, if uncontrolled, would in such a dose kill a guinea-pig of this weight in at least thirty hours. If the serum is strong enough in antitoxine for use upon the human subject, there will be no constitutional effect or local œdema observable in the guinea-pig; if the serum is too weak, there will be at least œdema at the point of inoculation within twenty-four hours. In the latter event another guinea-pig must be used and a larger quantity of the serum given, and so on, until the specimen of serum is standardized for dose. If it is very weak it is rejected.

A horse may be kept "immune" indefinitely by fresh doses of toxine—25 to 40 c. cm. every other day, and a 200-c. cm. dose about three days before bleeding. If the toxine injections are discontinued, the horse reverts to its original susceptibility. About 6 litres of blood may be drawn from the "immune" horse every three weeks, giving nearly seventy-five doses of immunizing serum from the first bleeding, one hundred from the second, and one hundred and twenty-five from the third.

The serum is administered to diphtheria patients subcutaneously with a Roux syringe of 20-c. cm. capacity. This syringe is made like the instrument used for giving the injections to the horse. Between the needle and the barrel there is a rubber tube about 5 inches in length, which permits considerable movement without pain on the part of the patient; it also enables the physician to inject the serum with more security. The syringe-barrel is opened and the entire instrument is boiled for five minutes to sterilize it; after it is cool it is filled with the serum. The skin over the eighth and ninth costo-chondral junctures is disinfected with, say, a 1-to-1,000 bichloride-of-mercury solution, and the needle is stuck under the skin, not into a muscle. The point of the needle should be directed toward the physician, to prevent dislodgment during the injection. The syringe is held against the palm, while the needle is pushed through the skin by the thumb and forefinger. The dose is slowly injected, little or no pain is caused, and the swelling at the place of injection soon disappears. After the injection a bit of absorbent cotton is laid upon the puncture. In slight cases of diphtheria, or in the early stages of the disease, usually one dose of 20 c. cm. is enough, but in severe cases, where there is mixed infection, several doses may be required, as will be explained below. When the serum is used as a preventive, 5 c. cm. are given to children under ten years of age and 10 c. cm. to older children. It will protect for probably six weeks. In all cases of suspected diphtheria, even before the bacteriological diagnosis is made, the physician should immediately inject 20 c. cm. of the serum. If the child is over fifteen years of age, give from 30 to 40 c. cm. in two injections, one on the left side and one on the right. The only possible ill effect will be a slight urticaria. If in from fourteen to twenty-four hours later the bacteriological examination proves the case to be diphtheria, no time will have been lost. The earlier in the disease the serum is injected, the better the chance for cure. Of course, a bacteriological diagnosis of diphtheria is the only diagnosis. Whether the German or French serum is used, there seems to be a reactionary rise of about one degree in temperature when the diphtheria bacillus is present.

[Some deaths have been attributed to the use of diphtheria antitoxine, and doubts have been entertained as to whether those deaths were attributable to the action of the serum itself or to some other cause. The question has been investigated experimentally by Dr. A. Seibert and Dr. F. Schwyzer, of New York (*New York Medical Journal*, May 30, 1896). Their conclusions are as follows:

"1. Antitoxic serum does not seem to be capable of causing threatening symptoms and speedy death, even when brought quickly into the blood current in very large doses.

"2. The carbolic acid used in preserving the antidiphtheric serum must be in such a weak solution as to be entirely unable to cause the characteristic carbolic convulsions produced in every one of our second series of experiments. The absence of these convulsions in the cases of sudden death in patients, the entirely different group of symptoms reported in them, and the fact that guinea-pigs and rabbits will survive even very large and concentrated doses of carbolic acid injected into a vein, lead us to discard the possibility of this drug having caused the reported deaths.

"3. Even very small quantities of air will cause severe disturbances and ultimate cessation of breathing in every animal experimented upon. These disturbances are entirely analogous to the symptoms reported as preceding the sudden deaths after antitoxine injections. Air is found alongside of the fluid in every syringe used for hypodermic injections, and being pressed under the skin with the fluid may readily come in contact with a punctured cutaneous vein and so may enter the blood-vessel and the right heart, even before the serum has been absorbed.

"In view of these facts and of our experiments, we here express our firm opinion that the sudden deaths reported after antitoxine injections were caused by injected air and not by the antidiphtheric serum."

The American Pædiatric Society has lately made a collective investigation into the use of antitoxine in the treatment of diphtheria in private practice. It was conducted by a committee consisting of Dr. L. Emmett Holt, Dr. William P. Northrup, Dr. Joseph O'Dwyer, and Dr. Samuel S. Adams. In the committee's report, presented before the meeting in Montreal on May 26, 1896 (*New York Medical Journal*, July 4, 1896), it is stated that only three cases,

in a total of 3,628, could by any possibility be classed as "cases in which unfavourable symptoms were, might have been, or were believed to have been due to antitoxine injections."

The first case was that of a girl, sixteen years old, in good condition, who had tonsillar diphtheria. The diagnosis was confirmed by culture. She was injected on the first day with 10 c. cm. of Behring's serum, and died in convulsions ten minutes later.

The second case was that of a fairly healthy boy, two years and a half old, who had the membrane on the tonsils, on the pharynx, and in the nose. The diagnosis was confirmed by culture. He was injected on the morning of the fourth day with 10 c. cm. (1,000 units) of the New York health board serum. His temperature at the time of the injection was 100·4° F.; there was no sepsis, and the child was apparently not very sick; the urine was free from albumin. He was distinctly worse after the injection; in ten hours the temperature rose to 103° F., the urine became albuminous, the throat cleared off rapidly, but marked prostration and great anæmia, with irregular fluctuating temperature, continued, and death from exhaustion with heart failure took place in four days after the use of the serum.

The third case was that of a boy, three years and a half old, who had been ill for two days. The diagnosis was confirmed by culture. The membrane was on the tonsils and in the nose. Two injections of New York health board serum were given. "A rapid nephritis developed after the second injection, causing coma, convulsions, and death twenty hours after the second injection." In response to an inquiry by the committee for further particulars, the following was received from the physician: "The case seemed a mild one, but the injection was given one afternoon and repeated the following afternoon, about fifteen hundred units in all. The urine up to that time had not been examined. About fourteen or sixteen hours after the second injection unfavourable symptoms began to develop pointing to infection of the kidneys. The urine was found to be loaded with albumin. My impression at the time was that the antitoxine either produced, hastened, or intensified nephritis, thereby causing the fatal termination."

The committee's comments on these three fatal cases are as follows: "Case I is wholly unexplained. In Case II the query arises, Did this sudden change hinge upon the injection of the serum, or was it one of those unexplained abrupt changes for the worse in a case apparently progressing favourably so often observed in diphtheria? As regards Case III, it will be seen from the letter that the evidence is not at all conclusive. All details available are given, and the reader may draw his own conclusions."

Certain secondary accidents are occasionally observed to follow the use of the antidiphtheritic serum. They are commonly limited to an urticarial rash and slight feverishness coming on within two or three days. They are thought to be due to the serum itself, and not to the antitoxine contained in it. According to Dr. Sevestre (*Bulletin de la Société médicale des hôpitaux*, 1896, Nos. 4 and 5; *British Medical Journal*, April 4, 1896), one sometimes sees about the thirteenth or fourteenth day after the injection a polymorphous eruption like that of measles or scarlet fever, more or less generalized, a reappearance of the urticaria, great constitutional disturbance, vomiting, excitement, delirium, insomnia, albuminuria, muscular and articular pains, inflammation of the glands, and more rarely an erysipelatous erythema at the site of the injection or elsewhere. These phenomena, says Dr. Sevestre, may be limited to a slight eruption, with a few transitory articular pains, or even to a passing feverish attack only recognisable by the typical date (always between the eleventh and fifteenth days) of its occurrence, which shows that the injection is the determining cause. As these accidents never appear in cases of pure diphtheria treated by serum, are very analogous to those produced by streptococci apart from serum therapy, and are always associated with the presence of virulent streptococci in the mouth or pharynx, their gravity, moreover, seeming to agree with the virulence of the cultures of the bacteria, they may properly be attributed, says Sevestre, to the action of the streptococcus. They are seldom very serious, though sometimes alarming, and they last four or five days. If a patient is seen at the beginning of a slight sore throat the case should be carefully watched till the result of the bacteriological examination is known, and if numerous streptococci are found with no Löffler's bacilli, one should abstain from injecting serum; if only that short bacillus which is not pathognomonic of diphtheria is found, one may hesitate about doing so; but if the case is one of pure diphtheria or, even apart from bacteriological examination, is serious or involves the larynx, there should be no delay; it will be a great advantage to have conquered one source of infection.

In the discussion, Dr. Hutinel, admitting the great resemblance of these accidents to those of streptococci infection, said he had found them where no streptococci were present. They were, he said, worse in children with large and chronically inflamed tonsils; he looked upon serum therapy as not to be adopted in children so affected, or in scarlatina, unless the diphtheria was characterized by long and numerous Löffler's bacilli. Dr. Le Gendre had seen serious accidents eleven days after the injection in a child in whom the short bacillus was associated, not with streptococci, but with staphylococci. Thibierge had reported a similar case (*Revue des maladies de l'enfance*, 1895). The short bacillus was not indubitably specific, and local treatment was better in such cases. Dr. Chantemesse, in twenty cases, had found that rectal injections of serum were well retained and readily absorbed, were as efficacious in the same doses as when used hypodermically, and caused no accidents.]

One of the greatest difficulties that will beset

the advance of serum therapy is the unskilled application of the immunizing serum. Local treatment should not be abandoned, because the associated bacteria, especially the pyogenic, may kill the patient after the diphtheria bacillus has been removed. No caustic should be applied to cause traumatism, and carbolic acid, and especially bichloride of mercury, work only bad effects when combined with the serum. The throat and nose should be sprayed or washed thrice daily with boric-acid solution or with a mixture of 2 fl. oz. of Labarraque's solution in a quart of water, to destroy the associated bacteria and the remaining diphtheria bacilli. The diphtheria bacillus remains in the mouth after the artificial immunization as long as it does after natural convalescence. It is well to remember that if no tongue-depressor is used a spray does not reach a child's throat. The patient must be well nourished, unless marked albuminuria indicates a milk diet. It is a common error to discontinue the use of antiseptic mouth-washes soon after the membrane disappears. They should be used until the microscope proves that no more pathogenic bacteria remain.

While using the serum we must keep account (1) of the temperature, (2) of the pulse, (3) of the respiration, (4) of the presence or absence of albuminuria, and we must know (5) whether we are dealing with simple diphtheria or with diphtheria complicated with other bacteria, especially with the streptococcus or staphylococcus of pus, or with both of these micro-organisms. If within from twelve to twenty-four hours after the initial injection the temperature, pulse, or respiration increases, or if noticeable albuminuria shows, a full, half, or quarter dose must be given, in keeping with the severity or multiplicity of these symptoms. Where there are pus germs mixed with the Klebs-Löffler bacillus it may be necessary to inject as many as 80 c. cm. of the French serum, in divided doses, according to the persistence of the symptoms. Kossel has found that where there is mixed infection it is well to give strong serum or larger doses of a weaker serum in order to destroy the diphtheria toxine quickly, and thus enable the patient to better contend with the pyæmia.

In simple diphtheritic laryngitis, where tracheotomy is indicated, the doses of the serum must be somewhat larger than for mere faucial diphtheria, and proportionally larger where there is a complication with pyogenic bacteria in a case needing tracheotomy. Antisepsis in the operation and treatment of tracheotomy should be perfect, because it is a serious evil to add pyæmia to diphtheria. If intubation were studied, especially in conjunction with serum therapy, tracheotomy could be avoided frequently where at present it seems to be necessary. Almost without exception, surgeons indifferently choose tracheotomy or intubation as if there were no special indications for either. The only real reason that prevents intubation from entirely replacing tracheotomy in hospital practice is that, unfortunately, the intubation tube will nearly always cause tissue erosion. The difficulty in intubating and the greater difficulty in extubating are surmountable. These operations are easier to perform upon the living subject than upon the cadaver, but no one should attempt them unless he is able to do them with the utmost gentleness within five seconds after a child is in position. If an O'Dwyer tube is left in contact with normal throat tissues for a while, no erosion is caused, but the result is very different when we have to deal with soggy diphtheritic tissues. The head, point, and bulging part of the shank of the tube all erode the glottis and trachea, and excite a cicatricial stenosis which only too often becomes permanent, especially when the clumsy European instruments are used. It is a great error to leave the tube in the throat longer than fourteen hours at any one time. Children not infrequently recover after the tube has been in position for days, but they are the exceptions, and this very practice has thrown the operation into disrepute. Take out the tube after from twelve to fourteen hours. The child may never need it again, or it may choke within five minutes. If it chokes, put back the tube. After a few trials of twelve hours' duration with persisting closure of the throat after removal of the tube, tracheotomy should be done. While the tube is out the physician must stay with the patient. This obligation prevents the use of intubation in private practice unless the physician is willing to take the faint chance of the patient's escaping erosion and stenosis after the tube has been left in for days.

If a child under two years of age is intubated, a serious tissue erosion will follow almost as the rule, unless the child is unusually large and robust. When the membrane is in the trachea, not only is intubation apt to push down the membrane, but erosion readily forms. Very severe diphtheritic croup with associated bacteria indicates tracheotomy in preference to intubation even though the wound infection be taken into consideration. In diphtheritic stenosis, where the cough is "dry" and the membrane firm, intubation does not succeed so often as tracheotomy.

In using the German serums it should be remembered that Behring's antitoxic serum is sent out in three grades of strength. "No. 2" is the grade usually employed, and this has about double the strength of the French serum. Aronson's serum is about as strong as Behring's "No. 2." Ten c. cm. of the German serum is the average dose.

[It appears from the American Pædiatric Society's collective investigation that the preparations chiefly used in the United States may be enumerated in the order of the frequency with which they are employed as follows: That furnished by the New York board of health, Behring's, Gibier's, Mulford's, Aronson's, and Roux's.]

There is no injurious effect upon the kidneys of patients upon whom the serum has been used, and the same is true for the lower animals. Roux says that before the use of immunizing serum two thirds of the cases of diphtheria showed albuminuria; after treatment with the serum fewer than one half show

albuminuria, and pneumonia and paralysis as consequences of the disease are much more infrequent.

The results are more than encouraging. If there are no associated bacteria, from 20 to 50 c. cm. of the serum will cure from 98 to 99 per cent. of the cases. As our knowledge of the use of the serum increases, the mortality lessens. From 1889 to 1894 in Paris the mortality of the tracheotomy cases was fully 85 per cent.; now less than 47 per cent. of these patients die, and the need for tracheotomy itself is not so often felt. The average mortality for all cases in Berlin, outside the tracheotomy cases, is down to 14 per cent. at present.

[There are still a few physicians who deny the efficacy of the antitoxine treatment of diphtheria. It seems to be abundantly proved, however. In the report of the American Pædiatric Society's collective investigation, already mentioned, it is stated that the circular letter which the committee had sent out called for information upon the following points: The patient's age; the previous condition; the duration of the disease when the first injection was made; the number of injections; the extent of the membrane on the tonsils, in the nose, on the pharynx, and in the larynx; whether or not the diagnosis was confirmed by culture; complications or sequelæ—viz., pneumonia, nephritis, sepsis, and paralysis; the result; and remarks, including statements as to other treatment employed, the preparation of antitoxine used, and the general impression drawn from the cases.

Reports were returned from 615 different physicians of 3,628 cases. Of these, 244 cases were excluded from the statistical tables. They were cases in which the disease was said to have been confined to the tonsils and the diagnosis not confirmed by culture, so that they were open to question. A few cases were reported in such doubtful terms as to leave the diagnosis uncertain. The figures given were therefore made up from cases in which the diagnosis was confirmed by culture (embracing about two thirds of the whole number) and others giving pretty clear evidence of diphtheria, either in the fact that they had been contracted from other undoubted cases or in the membrane having invaded other parts besides the tonsils, such as the palate, pharynx, nose, or larynx. "It is possible," says the report, "that among the latter we have admitted some streptococcus cases, but the number of such is certainly very small." There were left of these cases 3,384 for analysis. They were observed in the practice of 613 physicians from 114 cities and towns, in 15 different States, the District of Columbia, and the Dominion of Canada.

The report continues: "In the general opinion of the reporters the type of diphtheria during the past year has not differed materially from that seen in previous years, so that it has been average diphtheria which has been treated. If there is any difference in the severity of the cases included in these reports from those of average diphtheria, it is that they embrace a rather larger proportion of very bad cases than are usually brought together in statistics. The cases, according to the extent of the membrane, are grouped as follows: In 593 the tonsils alone were involved. In 1,397 the tonsils and pharynx, the tonsils and nose, the pharynx and nose, or all three were affected. In 1,256 cases the larynx was affected either alone or with the tonsils, pharynx, and nose, one or all. In many instances the statement is made by the reporters that the serum was resorted to only when the condition of the patient had become alarmingly worse under ordinary methods of treatment. This is shown by the unusually large number of cases in which injections were made late in the disease. Again, many physicians, being as yet in some dread of the unfavourable effects of the serum, have hesitated to use it in mild cases and have given it only in those which from the onset gave evidence of being of a severe type. The expense of the serum has unquestionably deterred many from employing it in mild cases. These facts, it is believed, will more than outweigh the bias of any antitoxine enthusiasts by including many mild cases which would have ended in recovery under any treatment. It will, however, be remembered that tonsillar cases not confirmed by culture have not been included."

In addition to the material which came to the committee in response to the circular, it had placed at its disposal reports of 942 cases treated in the patients' homes in the tenements of New York. Of these, 856 were treated with antitoxine by the corps of inspectors of the New York health board. In them the diagnosis of diphtheria was confirmed by culture in every case. They were of a more than ordinarily severe type, 485, or more than 50 per cent., of the patients being reported as being in bad condition at the time of injection; to mild cases the inspectors were not often called. Further, an unusually large number of them (38 per cent.) received the injection on or after the fourth day of the disease. In 182 of those cases only the tonsils were affected; in 466 the tonsils with the pharynx or nose, the pharynx and nose, or all three; in 294 the larynx was invaded either with or without disease of the tonsils, nose, or pharynx.

The committee received also a partial report upon 1,468 cases treated in the patients' homes in Chicago by a corps of inspectors of the health department. It was the custom in Chicago to send an inspector to every tenement-house case reported, and to administer the serum unless it was declined by the parents. These cases were therefore treated much earlier and the results were correspondingly better than were obtained in New York, although the serum used was the same in both cities—viz., that of the New York health board.

The grand total amounted to 5,794 cases with 713 deaths, or a mortality of 12·3 per cent., including every case returned; but the reports showed that in 218 cases the patients were moribund at the time of injection or died within twenty-four hours of the first injection.

Should these be excluded," says the report, "there would remain 5,576 cases (in which the

serum may be said to have had a chance) with a mortality of 8·8 per cent."

In the 4,120 cases of injection during the first three days there were 303 deaths—a mortality of 7·3 per cent., including every case returned. The report continues: "If from these we deduct the cases in which the patients were moribund at the time of injection, or died within twenty-four hours, we have 4,013 cases, with a mortality of 4·8 per cent. Behring's original contention, that if patients were injected on the first or second day the mortality would not be 5 per cent., is more than substantiated by these figures. The good results obtained in third-day injections were a great surprise to your committee. But after three days have passed the mortality rises rapidly, and does not differ materially from that of ordinary diphtheria statistics. Our figures emphasize the statement, so often made, that relatively little benefit is seen from antitoxine after three days; however, it must be said that striking improvement has in some cases been seen even when the serum has been injected as late as the fifth or sixth day. The duration of the disease, therefore, is no contra-indication to its use."

In the 3,384 cases reported to the committee, the larynx was stated to have been involved in 1,256 cases, or 37·5 per cent., a proportion somewhat higher than usual, and partly explained by the fact that several physicians sent in the reports of their laryngeal cases only. In 691, or a little more than half the number, no operation was done, and in this group there were 128 deaths. In forty-eight of them laryngeal obstruction was the cause of the fatal issue. In the eight remaining fatal cases the patients died of other complications, and not from the laryngeal disease. In the 563 cases, therefore, or 16·9 per cent. of the whole number, there was clinical evidence that the larynx was involved, and yet recovery took place without an operation. In many of these cases the symptoms of stenosis were severe, and yet disappeared after injection without intubation. No one feature of the cases of diphtheria treated with antitoxine, says the report, has excited more surprise among the physicians who have reported them than the prompt arrest, by the timely administration of the serum, of membrane which was rapidly spreading downward below the larynx. In the operative cases the same remarkable effects of the antitoxine were noticeable. Operations were done in 565 cases, or in 16·7 per cent. of the entire number reported. Intubation was performed 533 times with 138 deaths, or a mortality of 25·9 per cent. Among the cases were nine in which a secondary tracheotomy was done, with seven deaths. In thirty-two tracheotomy only was done, with twelve deaths, a mortality of 37·4 per cent. In the 565 operative cases, sixty-six patients either were moribund at the time of operation or died within twenty-four hours after injection. Should these be deducted, says the report, there remain 499 cases of operation by intubation or tracheotomy, with 84 deaths, a mortality of 16·9 per cent. In the 2,819 cases in which an operation was not performed there were 312 deaths, a mortality of 11·3 per cent. Deducting the moribund, or those that died within twenty-four horus after injection, the total mortality of all non-operative cases was 9·12 per cent.

The antidiphtheritic serum has been administered by the mouth with success. Dr. De Minicis (*Gazzetta degli ospedali*, July 19, 1896; *British Medical Journal*, August 15, 1896), on an occasion when his hypodermic syringe was out of order, determined to try the effect of antidiphtheria serum when given by the mouth. The result was eminently satisfactory. Since that time he has treated four other cases in a similar manner. In each case the effect was quite as good as if the serum had been given hypodermically, and no evil results followed—no gastric disturbance, no skin eruption, and no joint or renal affection. Before deciding as to the dose required, the author thinks further experience desirable. In the five cases the dose given was the same as would have been given hypodermically. The serum, which has no unpleasant taste, was administered in iced milk or pure.

Roux's antidiphtheritic serum has been employed in the treatment of *malarial fever* by Dr. Alcide Treille (*Gazette médicale de Nantes*, September 12, 1896; *New York Medical Journal*, October 24, 1896), who relates the histories of two cases in which he employed it with the following results: 1. In both cases the intense violent chill was completely suppressed after an injection of the serum, which was employed with the first patient in the beginning of the eleventh attack, and with the second patient in the beginning of the thirteenth attack. 2. The attacks were not modified in any way by the injections; the serum did not increase or diminish the temperature or the duration of the paroxysm, and only the chill that would have next followed the injection was suppressed. 3. In both patients the injection produced a veritable crisis twenty-four hours afterward, which manifested itself in the first patient by diarrhœa and in the second by a profuse sweating which was quite unusual and produced apyrexia for a day. 4. There was no eruption, abscess, or superadded fever. 5. In the first patient not only did the serum suppress the chill, but, from the beginning of the attack which followed the injection, all the stages were attenuated. After the fifth attack a spontaneous apyrexia occurred which lasted for five days; two more attacks then occurred which were followed by continuous apyrexia. Hence Treille concludes that the injection led to recovery. 6. In the second patient, who was young and in the full vigour of his life, the first injection led to the suppression of the chill, but it did not modify the attack. A second injection did not lead to other results than those obtained in the first case.

Preparations of quinine, says the author, must be employed. A daily dose of 4 grains for eleven days is necessary in order to produce the first apyrexia. Afterward 2½ grains are sufficient. The author states that, as he obtained absolutely similar results in another series of cases

of quartan fever with equally small doses of quinine, he is not able to say that the serum facilitated the action of the quinine in the second patient to whom he had been obliged to give it.

The use of serum containing an antitoxine is not confined to the treatment of diphtheria. Animals have been rendered proof against the diseases caused by various species of streptococcus, and their serum used to prevent or cure such diseases in man, including the *streptococcus infection complicating diphtheria* and that which gives rise to *erysipelas*. Dr. Gibier, of the New York Pasteur Institute, following the example of Dr. Marmorek, of Paris, prepares what he terms a "double," or "dual," antitoxine. This is held to be efficacious against both diphtheria and the streptococcus complication of that disease. In ordinary cases a dose of 15 c. cm. is injected, preferably into the lateral part of the abdominal wall, and after twelve hours 10 c. cm. more are injected; in severe cases 25 c. cm. are injected at first, and the same quantity again within twenty-four hours. Antistreptococcus serum, according to Dr. G. W. Van Schaick (*N. Y. Therap. Rev.*, 1895, No. 3), has been used successfully also in *puerperal fever*, *erysipelas*, and *phlegmons* following infection in operations.

In the *British Medical Journal* for October 31, 1896, Dr. John D. Williams, of Cardiff, reports six severe cases of *puerperal septicæmia* treated with antistreptococcus serum. Only one of them proved fatal. The serum used in one of the cases, which was among those of recovery, was obtained from the Paris Pasteur Institute; that employed in the other cases came from the British Institute of Preventive Medicine. Remarking on his own cases and eight others which he finds recorded, Dr. Williams says that two of the fourteen cases ended fatally. Eight of the patients were primiparous women, varying in age from twenty-two to thirty years. One was a case of abortion, and one was that of a multiparous woman with a rickety pelvis. In Vinay's cases no information is given as to age, character of labour, and the number of pregnancies. Excluding his cases, says Dr. Williams, we have left ten in which there is a definite record of the patient's state before and after the use of the serum. The labour was instrumental in six cases, lingering in one, and normal in two. In all the placenta came away easily and completely. Information as to the integrity of the perinæum is furnished in seven cases: it was torn but not sutured in four, torn and sutured in two, and uninjured in one. In six cases the lochia were scanty and suppressed in two. The reaction of the vaginal discharge was ascertained in three cases. Once it was found acid and twice alkaline. Dr. Williams says that his investigations into the reaction of the vaginal discharges in cases of puerperal septicæmia during past years seem to indicate that an alkaline reaction most frequently accompanies septic intoxication, sapræmia, and an acid reaction, septic infection—septicæmia. With the former reaction the lochia were usually found free and fœtid, and with the latter scanty or suppressed. In the ten cases referred to, symptoms of the disease set in from within a few hours of labour to the eighth day. The use of constitutional agents, combined with local and instrumental treatment, was tried in all the cases before the serum injections were resorted to, for a period varying from two to fifteen days. The earliest day after labour on which the serum was used was the fifth day, and the latest the nineteenth day.

The serum was not injected in a single case without a previous thorough trial of the usual constitutional and local remedies. The state of the pelvic organs was ascertained in nine cases, and with two exceptions, where there was uterine tenderness, they were found to be normal. The cases were characterized by severe febrile symptoms, and in some there were diarrhœa and vomiting. It must, of course, be admitted, says Dr. Williams, that puerperal infection may be independent of streptococci, but the conjunction of certain symptoms—rigours, high fever, and a rapid breaking up of the general condition—permit us to affirm a probability in favour of infection due to streptococci. Certainty is only to be obtained by a bacteriological examination.

Following each injection, says Dr. Williams, the previously hot, dry, and inactive skin passed into a state of moisture and active perspiration, the parched lips and dry tongue became moistened, suppressed lochia and lactation reappeared, delirium, insomnia, and restlessness passed off into a refreshing sleep, from which the patient awoke feeling better in body and clearer in mind. Headache and mental torpor were usually dispelled, but exceptionally the headache remained for hours, the patient otherwise feeling much relieved. The headache, which was described as "peculiar," was sometimes frontal and sometimes occipital. In three cases, however, no benefit resulted from the injections. Vinay, says Dr. Williams, believes the injections to be more effective and more immediate in their action when they are made early and at the time of the evening when there is a spontaneous rise in the temperature. Local treatment, curettage, and antiseptic washings are not to be neglected.

In all the cases analyzed by Dr. Williams, with the exception of three, the degree of temperature and the frequency of the pulse were reduced after each dose of serum. The reduction of temperature and decrease of frequency of the pulse were effected in from six to twenty-four hours. The temperature in one case fell from 104° to 102° in six hours after 10 cubic centimetres of the serum (from the Pasteur Institute), but it rose to 103° eighteen hours later. A second dose of 20 cubic centimetres reduced it to normal in ten hours, and it remained so. In one case the temperature followed an exceptional course. After a single dose of 35 cubic centimetres (Ruffer's serum) the temperature fell from 104·4° to 104° in six hours. At the twelfth hour (midnight) it rose to 105°, but at the eighteenth hour it fell to 102°, and at the twenty-fourth hour to 99·2°,

and remained under 100° from this time onward. This was the only instance in which a rise was observed after an injection. In three cases the temperature fell to normal in twenty-four hours. The pulse rate varied with the temperature.

In Dr. Williams's fatal case the patient received a daily injection of 20 cubic centimetres for three consecutive days, with no observed benefit. She died on the fourteenth day, the fever remaining high to the last. With regard to this case, Dr. Williams says he can not help feeling that if it was a case of strepto-infection, and a larger initial dose had been administered, a different result might perhaps have been obtained, but if, of course, it was one of staphylo-infection no benefit was to be expected. This, he remarks, shows the supreme importance of a bacteriological diagnosis. Gaulard's fatal case, however, stands in a different light. Here a bacteriological examination had been made, and the case undoubtedly proved to be a true example of strepto-infection—streptomycosis. A dose of 10 cubic centimetres of serum (Marmorek's) was injected on the fourth, fifth, sixth, and seventh day after confinement, and by it the temperature was reduced to normal on the ninth day. On the evening of this day, however, the patient was seized with bilious vomiting and meteorism. The next day she was much worse, had uncontrollable vomiting, and became semicomatose; she died on the eleventh day, the temperature remaining low to the end. The serum was effective in reducing the temperature, yet the patient died two days later during convalescence. Gaulard, after the post-mortem examination, attributed her death to the use of too much serum. The total amount injected was 40 cubic centimetres, spread over four days. In view of his own experience, Dr. Williams can not agree with him, as in one case he injected 60 cubic centimetres (British Institute) during three days, and Kennedy used 85 cubic centimetres in two days, and both patients recovered.

There may, of course, says Dr. Williams, be a difference in the strength of the fluids used. This emphasizes the desirability of bacteriologists' adopting a uniform system of standardizing their serum. An erythematous rash appeared on the chest, abdomen, and extremities in two cases. It was of a fleeting character, and disappeared in the course of a few days without calling for any treatment. Patchy pneumonia of the base of each lung complicated one case. The first and second injections of 30 cubic centimetres were made on the eighth and twelfth days respectively. The temperature fell after each. On the seventeenth day there were signs and symptoms of pneumonia. During this attack the temperature ran a fluctuating and an exceptionally high course, being 106° on the twenty-first and 108° on the twenty-third day. The patient's physician looked upon the serum with suspicion, and feared it was the cause of the pneumonia. The serum used was supplied by Dr. Ruffer. Is it possible, asks Dr. Williams, that the serum, owing to defective filtering or something else, contained living streptococci? Might a serum containing living germs, or might the antitoxine found in an efficiently filtered and germ-free serum, give rise to patchy pneumonia in a puerperal patient with a decided phthisical family history?

In the cases reviewed by Dr. Williams the serum was administered by subcutaneous injection into the areolar tissue of the abdominal wall; to avoid septic troubles, the skin was washed with Johnston's antiseptic ethereal solution of soap, and then for two minutes with perchloride-of-mercury lotion (1 in 1,000), and finally dusted with boric-acid powder. The syringe used was Debove's, of the capacity of 10 cubic centimetres. It was taken to pieces and placed in a pie dish, which was boiled in a clean saucepan for fifteen minutes at the patient's home. Ten cubic centimetres were injected into each puncture, three such punctures being made for a dose. In no instance was there local trouble.

The question of a maximal dose beyond which it is unsafe to go Dr. Williams regards as not yet settled, and he adds that supplies of serum derived from different sources or from the same source at different times are not guaranteed to be of the same uniform strength. He thinks it desirable that a uniform system of standardizing should be adopted by bacteriologists, and says that when this is accomplished clinical observers will be better able to agree as to what the maximal and submaximal doses should be. At present the practitioner has to rely for guidance upon the instructions which accompany each supply, and these vary with their source.

In regard to the cases in which this treatment is suitable, Dr. Williams remarks that puerperal infection may be independent of streptococci. According to Bulloch, recent research shows that a puerperal fever may be set up by the gonococcus, the *Bacillus coli communis*, the Talamon-Fraenkel coccus, and the staphylococcus. In the majority of instances, however, puerperal fever means infection of the genital canal, and ultimately of the whole system, with the *Streptococcus pyogenes*. There is produced a septicæmia—using the term in the sense in which it was originally employed by Koch—namely, a condition of microbic blood infection where the microbes multiply in the blood and cause a rapidly fatal disease. The microbe at work most commonly is the *Streptococcus pyogenes*, and the type of infection or septicæmia induced is called puerperal strepto-infection or streptosepticæmia, or, in the language of the bacteriologist, streptomycosis. It is in this class of cases only that the antistreptococcic serum is of value, the serum is specific against the streptococcus only, and attempts to cure with it staphylosepticæmia or infection caused by any other germ will not be successful. The symptoms found in cases of severe puerperal septicæmia point to a strepto-infection, but in the absence of a bacteriological examination one can not be certain. The strepto-infection is at first essentially a local disease; it is later that it becomes a

blood infection. Therefore local treatment, antiseptic douches, and curetting can not be dispensed with, but must be carried out in conjunction with the serum treatment, which comes into play when the germs have passed into the general circulation by annulling their action and toxine and obviating the organic degenerations which are beyond our control.

The serum treatment of forms of septicæmia and suppuration due to other micro-organisms than the streptococcus is still in the experimental stage.

In the *British Medical Journal* for July 4, 1896, Mr. Charles A. Ballance and Mr. Francis C. Abbott, of St. Thomas's Hospital, London, report a case of *acute hæmorrhagic septicæmia* occurring in a physician, thirty years old, who pricked his thumb in making a post-mortem examination in a case of suppurative peritonitis at 1.45 P. M. on Monday, June 8th. At 7 P. M. the thumb began to throb, during the evening this throbbing increased to burning pain, and between 9 and 10 the red lines of lymph-duct inflammation had extended as far as the axilla, and the glands in that region were enlarged. At 4 A. M. on June 9th pain and tension of the pad of the thumb were so great that nitrous-oxide gas was given and an incision made. Previous to this vomiting had occurred, and there had been several shivering fits. The temperature at 7.30 A. M. was 103° F.

At 9.30 A. M. he was seen by one of the authors. The whole body was covered with a scarlet septic erythema, the face was puffy, and the eyes were suffused. The patient complained of severe shooting pains up the arm, and in the intervals of pain was listless and drowsy; the temperature was high and the pulse rapid and soft. It was arranged at once to take him as soon as possible to the hospital, where he was admitted about 3 P. M.

The condition gradually grew worse, and on the evening of the following day (June 10th) the temperature was 104·7° and the pulse 150, soft, feeble, irregular at times, and "running." The rash was very brilliant, and hæmorrhagic in places. All day drowsiness had been a marked feature; the respiration was more rapid than normal, and occasionally jerky. Nourishment was taken with difficulty. There was soreness of the throat, which was of a brilliant red colour. During the day vomiting occurred several times, and also slight bleeding from the nose. Coughing, too, was troublesome, and he hawked up blood-stained mucus from the pharynx. There was no swelling of the thumb, and no discharge of pus from the incision, but there was great pain and tenderness along the forearm and arm, though without obvious swelling or œdema. The axillary glands were large and tender. The red lines were obscured by the rash, but the hard lymph cords could be felt. There was frontal headache, and the mind was clouded. The tongue had gradually become coated and dry, and was passing into a typhoid condition. There was slight albuminuria.

At midnight (June 10th–11th) 3·5 c. cm. of antistreptococcus serum (Burroughs and Wellcome) were injected. This was repeated every four hours. Six hours after the first injection (6 A. M., June 11th) certain indications of improvement were manifest:

1. The mind was clear and the headache had disappeared.
2. The respiration was regular and less rapid.
3. The pulse was slower.
4. The tongue was moist along the edges.

On June 11th the temperature was continuously 104° F. Cold sponging, which was done several times, had no real effect. The tongue continued to clean, but a smart attack of epistaxis occurred. The rash was still as bright, and the blotchy subcutaneous hæmorrhages were more evident. Toward evening, after the epistaxis occurred, the pulse became much more rapid and weak, and gave rise to much anxiety. Strychnine and digitalis were ordered every four hours.

During the night the temperature dropped, but much pain and some swelling were noticed in the ball of the thumb, and there was tenderness above the wrist on the radial side, with slight œdema. Notwithstanding the bad night, the general condition was better.

On June 12th the skin was moist, and the tongue was steadily cleaning from the edge, leaving a marked pink, moist surface, such as is seen on the throat in diphtheria when the membrane clears under the use of antitoxine. Chloroform was given, and an incision into the thenar eminence, opening the sheath of the tendon, was made; also one over the first phalanx of the thumb. The parts, though swollen and tense, contained no visible pus. At midday the dose of antitoxine was doubled, 7 c. cm. being injected every four hours.

No further incisions were necessary, the swelling and œdema above the wrist gradually disappeared, and the incisions all began to heal without any visible discharge of pus. The rash did not disappear entirely until June 16th.

The use of the antitoxic serum appears to the authors to have produced the following effects:

1. The mind became clear notwithstanding the high fever.
2. The frontal headache ceased.
3. The tongue began to clean and become moist from the edge until it was clean, moist, and of a peculiar pink colour all over.
4. The pulse became slower and of better quality.
5. The respiration was slower and never jerky afterward.
6. The skin, which was dry and burning, became moist, and sweating occurred.
7. The wounds healed without suppuration, and the threatened inflammation of the great synovial sac under the anterior annular ligament subsided.

Every care was taken to asepticize the syringe used for the injection, to cleanse the skin at the site of injection, and to maintain the sterility of the serum by keeping it in ice, and using other obvious precautions. The injections were given into the loin and abdominal wall. Notwithstanding the large number of

injections (twenty-eight in all, eight of 3·5 c. cm. and twenty of 7 c. cm.), no local reaction occurred at all except a fleeting urticaria limited to the site of injection, which was noticed once or twice, and did not produce any inconvenience.

The recovery, the authors add, would seem to encourage the employment of the antistreptococcus serum in many other serious surgical conditions. Among many others, the following occur to them: *Fracture of the skull with risk of suppurative meningitis, acute necrosis, acute septicæmia* or *pyæmia* from any cause, *rapidly spreading gangrene* or *cellulitis, erysipelas, general suppurative peritonitis*, and the *septic complications of middle-ear disease.*

With regard to the dose, they would be inclined to begin by injecting a large one—say 20 c. cm.—and then to give a smaller dose—say 7 c. cm. every four hours. After most of the injections given in the case related, the temperature temporarily dropped, but soon rose again, and they fancy that it is of great importance to give the injections frequently.

In the *Lancet* for October 17, 1896, there is a report of a case of *ulcerative endocarditis*, by Dr. Harrington Sainsbury, in which the antistreptococcus serum was employed with success. Dr. Sainsbury refers, however, to another case that had come under his care in which the serum failed to arrest the disease or, apparently, to have any beneficial effect.

Scarlet fever has to some extent been subjected to the serum treatment. M. Roger (*Presse médicale*, August 26, 1896) gives an account of a case in which the symptoms seemed to point to a rapidly fatal termination, so that he resolved to make a trial for the serum treatment. The preparation for this occupied an hour, during which time the patient's condition became worse, and death seemed imminent. At eleven o'clock in the morning phlebotomy was practised on the patient, and afterward 80 cubic centimetres of defibrinated blood which was taken from a patient convalescent from scarlatina were injected under the skin of the abdomen. Five hours later the patient was sleeping quietly and breathing easily. When he awoke and moved, the respiration changed and became of the Cheyne-Stokes type; the pulse was 120 and feeble; the tongue was moist; the temperature, however, remained high and no urine was passed. A bath of 82° F. was then given and the temperature began to fall. Three hours later 12½ oz. of saline solution were injected subcutaneously and in an hour urine was passed. Two hours later the patient was sleeping quietly: the pulse was 100, and the respiration 25. On the following day the patient was completely changed; he felt better and asked for food; his tongue was raw but moist; the eruption was pale, except on the legs, where it was still very pronounced; the pulse was 80, feeble but regular; and the respiration was 22. During the twelve hours following the last injection the patient passed 1,100 cubic centimetres of urine, which was of a dark-red colour, but it contained no albumin. The temperature during the day ranged about 100·2° F., and on the following day it became normal. For several days afterward nothing special was noted, and the infection terminated rapidly. M. Roger says that he has never seen such a rapid recovery follow in such a grave case of scarlatina.

Defervescence was rapid instead of being progressive, as is usually the case, and the disease terminated suddenly. This, M. Roger thinks, is one of the best arguments in favour of the serum treatment.

The antidiphtheritic serum also has been used in the treatment of malignant scarlet fever. M. Fourrier (*Gazette hebdomadaire de médecine et de chirurgie*, August 27, 1896), used this serum in the case of a young child who showed an angina during the course of grave scarlet fever. The case was almost hopeless at the moment the treatment was begun, but from the first injection the coma into which the child had sunk disappeared and the subsequent injections led to a rapid recovery. Since then M. Fourrier has employed this treatment in five similar cases, with the most successful results, and he recommends it in all grave cases of scarlatina.

Marmorek's antistreptococcus serum, too, has been employed in the treatment of scarlet fever. M. Josias (*Semaine médicale*, May 20, 1896; *British Medical Journal*, August 8, 1896), bearing in mind the fact that most of the complications of scarlet fever are due to infection with the streptococcus, treated some cases with antistreptococcic serum. In the first period forty-nine children were treated with an average dose of 5 cubic centimetres of the serum obtained by Nocard from a sheep. Except urticaria, no bad symptoms were observed. In the second period ninety-six children were treated with an average dose of 10 cubic centimetres of the serum, some, however, receiving as much as 90 cubic centimetres. This serum was obtained from a horse, and was much more active than that from the sheep. Streptococcic abscesses at the seat of inoculation occurred in four, lymphangeitis in eight, polymorphic eruptions in ten, and purpura in seven cases. As a result of this treatment Josias thinks pseudo-membranous angina, unaccompanied by suppurating glands, improve more quickly than usual. It had no effect, however, on suppuration, even though due to the streptococcus, and none on albuminuria, the temperature, or the general course of the disease. The mortality in cases treated without serum was 5·81 per cent.; in those treated with serum from the sheep, 2·08 per cent.; and in those treated with serum from the horse, 5·31 per cent. Thus the lowest mortality was observed in those treated with the serum obtained from the sheep, which was the least active of the two.

Dr. Weisbecker (*Zeitschrift für klinische Medicin*, 1896, Nos. 3 and 4; *Therapeutische Wochenschrift*, June 28, 1896; *Journal of the American Medical Association*, August 8, 1896) has experimented with serum from patients recovering from *measles*, with which he injected others in the incubatory stage. He considers the results quite satisfactory, as the

incipient disease was much modified, and cases of measles with pneumonia were cured.

The serum treatment of *small-pox* has been shown to be rational and efficient, but as a preventive it is not likely to supplant vaccination. Dr. A. Béclère (*Presse médicale*, August 12, 1896; *New York Medical Journal*, September 5, 1896) gives a brief account of nineteen cases which came under his observation in the hospitals of Paris and of Marseilles. Among the adults the total quantity of serum which was injected under the skin varied from a pint to a pint and a half, and twice it even exceeded this quantity. Young children received doses of from 2 fl. oz. to half a pint, according to their weight. In adults it was often very difficult to inject more than a fiftieth of their weight; in some emaciated subjects M. Béclère was able to inject a thirty-third of their weight, but he never exceeded this dose. These enormous quantities of serum, which were introduced into the subcutaneous cellular tissue, were rather rapidly absorbed and did not provoke any accidents except the appearance, in certain cases, from six to ten days after the injection, of a morbiliform exanthem which was sometimes accompanied by urticarial elevations; ordinarily it was rather pale, rarely generalized, nearly always apyretic, and always of short duration; there were no general troubles. The serum of heifers, whether they have been vaccinated or not, says M. Béclère, is generally better tolerated by the human organism than horse serum.

The treatment of *tuberculosis* by the use of serum prepared on the principles that govern the production of the diphtheria antitoxine has proved successful in a number of instances. Professor E. Maragliano, of Genoa, has obtained from the dog, the ass, and the horse a serum which he presumes to contain a tubercle antitoxine. He gives a summary (*Gazzetta medica Lombarda*, April 20, 1896; *British Medical Journal*, May 16, 1896) of the results observed in his own practice and in that of his colleagues and other practitioners who have reported to him. The statistics include all the cases of which he has knowledge up to February 15, 1896. The total number of cases is 412. These are subdivided as follows: 1. *Destructive bronchopneumonia with cavities*, 93; 7 patients were apparently cured, 35 were notably improved, and 34 were unchanged, while in 17 the disease went steadily on to a fatal issue. 2. *Destructive bronchopneumonia without demonstrable cavity*, and with microbic associations (that is, mixed infection), 85; 9 patients were apparently cured, 45 were improved, 24 were unaffected, and 7 died. 3. *Diffuse febrile bronchopneumonia*, with or without destructive processes, 104; 7 patients were apparently cured, 55 were improved, 32 were not affected, and 10 died. 4. *Diffuse non-febrile bronchopneumonia* with or without destructive processes, 43; 2 patients were apparently cured, 31 were improved, and 10 were not affected. 5. *Circumscribed febrile bronchopneumonia*, 54; 20 patients were apparently cured, 31 were improved, and 3 were unchanged. 6. *Circumscribed non-febrile bronchopneumonia*, 33; 22 patients were apparently cured, 9 were improved, and 2 were not affected. The author explains that when he speaks of "cure" he means only the complete disappearance of every symptom of the disease for the time; he declines to commit himself to any statement as to the permanence of this state of things. The number of "cures" varies according to the severity of the disease when treatment is begun. In the cases here summarized the proportion of "cures" in the cases with cavities was 7·76 per cent. The proportion rises through intermediate forms till in cases of circumscribed non-febrile tuberculosis in which the treatment has been fully carried out it reaches almost 100 per cent. In 98·30 per cent. of the cases included in the statistics all the ordinary methods of treatment had been tried in vain. Maragliano sums up as follows: 1. The remedy has been proved to be quite innocuous. 2. It has caused subsidence of fever. 3. It has had a modifying influence on local morbid processes. 4. It has caused the bacilli contained in the sputum to diminish in number or to disappear. 5. It has brought about notable increase of weight. 6. It has had a beneficial effect, more or less marked according to the gravity of the disease, in 91·75 per cent. of the cases. 7. It has cured, or put on the way to cure, nearly all the patients with circumscribed non-febrile forms of the disease. 8. It has cured even cases in which cavities had formed. 9. It may be used with advantage in all forms of tuberculosis. Maragliano at first recommended that treatment should be begun with the injection of 2 c. cm. of the serum every two days, and then after ten days the same amount every day, and after ten days more daily injections of 2 c. cm. Further experience has convinced him that equally good effects can be obtained with smaller doses, and he now recommends that 1 c. cm. of the serum should be injected systematically every two days. In cases of subcontinuous fever, with persistent high temperature, however, 5 and even 10 c. cm. may be injected in one dose, and repeated after from five to eight days, and so on, when after two or three days an appreciable depression of the thermic curve is noted.

It appears from an important article by Dr. Zaeslein, of Genoa (*Deutsche Medizinal-Zeitung*, July 27, 1896; *New York Medical Journal*, August 15, 1896), that Koch's tuberculin, although it has proved a failure as a curative agent, does lead to a formation of antitoxine, but it is not known that sufficient antitoxine to prove curative can be produced by the use of safe doses. The employment of tuberculin as a therapeutic measure having therefore been practically renounced, some experimenters, especially Richet and Héricourt, sought to cure tuberculosis by injecting the normal serum of such animals as the goat and the dog, which are naturally almost completely proof against the disease; but the results were not very encouraging.

Then animals were treated with tuberculous matter, in order to engender large amounts of

antitoxines in their blood. For that purpose Maragliano used cultures of the tubercle bacillus, but without living bacilli; Behring, Wernicke, Knorr, and Niemann employed tuberculin; Babes and Broca made use of the bacilli of the tuberculosis of birds, human tuberculin, and dead or attenuated cultures of the human bacillus; and Paquin used cultures from tuberculosis. The serum of animals systematically treated with any of these materials, says Zaeslein, annuls the action of tuberculin; Maragliano first announced this with regard to his product in August, 1895. Wernicke, Knorr, and Niemann employed only those culture products that resist heat, but Maragliano uses also those that are destroyed by heat, and Zaeslein thinks it probable that this is of great advantage. Babes and Paquin have had some good results, but there are no statistics to compare with Maragliano's, which now include four hundred and fifty cases. The use of his serum, says Zaeslein, has passed the experimental stage, and may safely be received into practical therapeutics, for the dose in antitoxic units is adjustable and calculated for long periods and the use of the remedy rests on adequate clinical observation.

For the inoculation of animals, Maragliano uses the filtrate of cultures that have been heated, as well as that of those that have not been heated. The first-mentioned are prepared by steaming highly virulent pure cultures at a temperature of 212° F. for three or four days, and then treating them in the same way as for producing Koch's tuberculin; in the preparation of the last-mentioned, the cultures are filtered through a Chamberland filter at the ordinary temperature, and then placed in a vacuum with the temperature never above 86° F. The first product contains all the toxic elements that resist heat—i. e., the bacterial proteins, or tuberculins; in the second there are the toxalbumins, which do not bear heat, and tuberculins also, for in all cultures there are fragments of bacilli which doubtless contribute tuberculins to a solution. Now, as it is known that not all cultures are equally toxic, an unchanging toxic unit has to be established, in order that the animals may be inoculated uniformly. This is accomplished by greater or less concentration of the filtrates, and the unit consists of a weight sufficient to kill a healthy guinea-pig of a certain weight; in this case the two filtrates are concentrated to such a degree that a cubic centimetre will contain a hundred toxic units —i. e., a cubic centimetre for each 1,500 grains of the guinea-pig's weight will be required to kill the animal. In the inoculations three parts of the heated and one part of the unheated filtrate are employed, the operator beginning with 2 milligrammes for each kilogramme of the animal's weight, and increasing the dose regularly by 1 milligramme daily until it reaches from 40 to 50 milligrammes, at which it is to remain. Dogs, asses, and horses are employed, and ordinarily the inoculations are continued for six months. The animal will then withstand large doses of virulent cultures, even by intravenous injection. Before blood is drawn from the animal there is a pause of three or four weeks, in order to make sure that the serum contains no residue of the poisonous substances that have been injected. The serum is separated and treated according to the ordinary method.

The physiological action of the serum on man is as follows: In a healthy person the curative serum as such has no effect on the temperature; however, like any other animal serum, even that of animals that have not been inoculated, in certain individuals it may, especially if used in large doses, cause a rise of temperature, but the fact of its coming from an inoculated animal has nothing to do with this. It has no direct influence on the circulation; when, however, a tuberculous patient's general condition improves after a series of injections, the pulse grows correspondingly slower and fuller. There is often a striking increase in the number of leucocytes in the blood; in tuberculous persons the number of the red corpuscles and the amount of hæmoglobin also are increased in proportion to the improvement of the general condition. In general, there is no perceptible effect on the urine, but when a large dose, as much as 10 cubic centimetres, is given at one time, temporary peptonuria may occur, but never glycosuria or albuminuria. The appetite is almost always increased, also the weight; if the loss of flesh has been only slight, there will be but little increase, but in very emaciated persons the gain will be striking, amounting in some instances to as much as 30 pounds.

Zaeslein then proceeds to the effects of the treatment on the manifestations of the disease, considering first those that are local. The chief effect elicited by auscultation, he says, is a diminution and final disappearance of the râles, which means a drying up of the deposits, beginning with those that are recent and slowly extending to the older ones. Subsequently the areas of dulness diminish or disappear. These effects occur even in cases in which no other measure has been of any avail and whether or not there is fever and whether or not heredity is playing a part. Now and then a tendency toward cure is perceptible within a few days, and usually in the course of a month, if the process is not too far advanced and not too many other bacilli are present. Slight fever usually disappears slowly when the treatment is carried out according to Maragliano's directions; high fever may abate and, if the progress of the case is to be favourable, subside entirely. Very high fever and the subcontinuous fever which occurs in the final stage may be reduced or overcome if large doses of the serum are employed—from 5 to 10 cubic centimetres every fifth, sixth, or seventh day, but only for two or three days; this effect is not constant and generally not lasting.

A tolerably constant effect is a gain in weight, even if the fever continues. Maragliano says: "The patient gains weight because he eats more, it is true, but it is because the serum treatment enables him to eat more."

As the other symptoms are ameliorated, the number of tubercle bacilli in the sputa becomes reduced, slowly of course in severe cases; finally they disappear entirely and not merely for the time being, provided the treatment is energetic and continued long enough. As regards the general condition, many patients say that they feel stronger after the first few injections, and they are inclined to do some work, which for a long time had been impossible for them; but this, of course, is only a subjective phenomenon. After further treatment the whole scene changes—there is a sharp appetite, the patients take long walks without exertion or fatigue, and they do not get out of breath. Moreover, their sleep is long and restful.

As regards the different forms and stages of the disease, Maragliano divides all cases of pulmonary tuberculosis into two great groups —those in which Koch's bacillus is the only micro-organism, or almost the only one, found in the sputa, and those in which there is an abundance of other microbes, such as streptococci, staphylococci, and the diplococcus of pneumonia, constituting what he calls "microbial associations." In these latter cases the cure, although not impossible, is difficult and protracted; they are the ones in which the old remedies must not be neglected on account of the serum treatment. Besides the question of which of these two great divisions the case belongs in, one has to take into account four other considerations: The "quality" of the disease (whether there is only catarrh or infiltration, whether the infiltration is compact or disseminated, whether there is a tendency to caseation or to cirrhosis, and whether or not there are cavities); its "quantity" (the amount of tissue diseased); its intensity; and the patient's general condition. All these data are of importance in the prognosis.

Maragliano's statistics relate to four hundred and forty-five cases, including the eighty-two that he reported in August, 1895, before the Société française de médecine interne, those recorded or reported to him by other Italian physicians, and a few contributed from France and Austria. When Maragliano speaks of a cure, he means a "provisional cure," manifested by the disappearance of all subjective symptoms and all physical signs except dulness on percussion. The cases are divided into six groups as follows:

1. *Patients with destructive bronchopneumonia and cavities*, 105.

Cured	8
Improved	37
Not affected	37
Grew worse	23

Eighty-two of these patients had fever. It disappeared in twenty-nine, was reduced in sixteen, and remained stationary in thirty-seven. The local signs disappeared in twenty, were mitigated in thirty, and were unchanged in forty-eight. The weight increased in forty-three cases, remained stationary in twenty-six, and decreased in seven.

2. *Patients with destructive bronchopneumonia, without recognisable cavities, with "microbian associations,"* 85.

Cured	9
Improved	45
Not affected	24
Grew worse	7

The fever disappeared in forty, abated in eleven, and remained the same in twenty-one. The local signs disappeared in fifteen, were improved in forty, and remained unaffected in twenty-one. Forty-three gained flesh, four lost weight, and in twenty-two there was no change of weight.

3. *Patients with diffuse febrile pneumonia, with or without a destructive character*, 120.

Cured	11
Improved	61
Not affected	35
Grew worse	13

The fever disappeared in sixty, grew less in twenty-two, remained the same in twenty-nine, and increased in eight. The local signs vanished in twenty-four, were improved in fifty-one, remained stationary in twenty-nine, and were aggravated in twelve. Forty-eight gained flesh, eight lost, and in twenty-two there was no change.

4. *Patients with diffuse non-febrile bronchopneumonia, with or without destruction*, 47.

Cured	2
Improved	33
Not affected	11
Grew worse	1

The local signs disappeared in eleven, remained the same in thirteen, and were improved in twenty-two. The weight increased in twenty-four and was unchanged in twelve.

5. *Patients with circumscribed febrile bronchopneumonia*, 54.

Cured	20
Improved	31
Not affected	3

The fever disappeared in forty-seven, was unchanged in four, and was aggravated in one. The local signs disappeared in twenty-five, were improved in twenty-five, remained the same in three, and were intensified in one. Forty-four gained in weight and in four there was no change.

6. *Patients with circumscribed apyretic bronchopneumonia*, 34.

Cured	22
Improved	10
Not affected	2

The local signs disappeared in twenty-three, were improved in eight, and were unchanged in two. The weight increased in twenty-seven and was not affected in one. It is explained that the omission of some of the data in the foregoing statistics was due to defective histories having been sent in some instances.

To summarize the results, the fever disappeared in 176 out of 322 cases—in 55 per cent.

of cases of bronchopneumonia with "microbian associations," in 32 per cent. of those of cavities, in 48 per cent. of those of diffuse bronchopneumonia, and in 86 per cent. of those of circumscribed bronchopneumonia. The local signs disappeared in 27 per cent., were improved in 41 per cent., were unchanged in 30 per cent., and were aggravated in 6 per cent. [so the account says, but these numbers added together make 104; consequently there has been a slip of the pen]. There was an increase of weight in 57 per cent. The tubercle bacilli disappeared in 43·2 per cent. (in 54 per cent. of the febrile bronchopneumonias and in 88 per cent. of the non-febrile circumscribed bronchopneumonias).

As a general thing, a cubic centimetre of the serum was administered subcutaneously every other day, and the temperature was carefully observed. Inasmuch as a few persons are sensitive even to this dose, half a cubic centimetre may be given to begin with. Such individuals may be recognised by their showing a febrile reaction on the injection of 2 cubic centimetres of a physiological salt solution. In the great majority of instances there was neither a rise of temperature nor any other disturbance, even when the treatment was continued for many months. When a rise of temperature occurred the treatment was suspended until it fell, but even in such cases a definitive apyrexia occurred in time. When the treatment, thus employed, failed to affect patients who had high fever and were in bad general condition, from 5 to 10 cubic centimetres of the serum were given every fifth day; when three or four such injections had been given without avail, it was thought useless to continue with them, and the ordinary plan of using small doses was resumed.

The use of the serum should be continued until a cure results, then two injections a week should be given for two months, and after that one injection a week for a year. The side of the chest and the back are the preferable parts for the injections. They are no more painful than injections of morphine; occasionally a little swelling occurs, but it subsides in a few days, rarely there is urticaria, and no other accidents are observed. The serum is described as clear and free from flocculi and sediment. Not until it has been kept for a long time does it become turbid, and then it had better be discarded, although the flocculi seem to consist only of precipitated albumin.

Dr. Cattaneo (*Gazzetta degli ospedali*, March 14, 1896; *British Medical Journal*, August 15, 1896) gives an account of two cases of infantile tuberculosis treated with Maragliano's serum. He first points out the advantages offered by tubercle in children for the observation of this method, presenting as they often do local lesions which tend readily to infect other tissues, and thus forming what may be termed test cases. In each of the cases which he records the patient was kept under observation for twenty days previous to the beginning of the treatment, and during the whole of this time, as also during that of the treatment, the following amount of food was given: Bread, 100 grammes; rice, 150 grammes; broth, 250 grammes; meat, 80 grammes; two eggs; red wine, 100 grammes; Marsala wine, 100 grammes; milk, 200 grammes. The first patient was a girl, aged three years, whose father had died of pulmonary tuberculosis and two brothers of pulmonary disease, probably tuberculous. She was poorly developed and had flaccid muscles, dry skin, enlarged glands, enlargement of the liver and spleen, 40 per cent. hæmoglobin, 4,624,000 red blood-corpuscles, evening temperature with maximum 102·2° F., body weight 7·55 kilogrammes. The treatment consisted of fifty injections in all, at first on alternate days, then, being well borne, every day. In the first fortnight there was a rapid improvement in the general condition and appetite, and the child was more brisk and playful. The hæmoglobin was 55 per cent., the red blood-corpuscles were 4,820,000, and there was a decrease in the number of white blood-corpuscles. At the end of the treatment there was no cough, the liver was reduced in size, the spleen did not protrude from under the ribs, and the glands were smaller. The hæmoglobin was 55 per cent., the red blood-corpuscles numbered 4,584,000, there was no fever, the weight of the body was 8 kilogrammes, the general condition was good, also the appetite, and the patient was active and playful.

The second patient was a girl aged five years. Her family history was negative; dentition had been late, and she had had intestinal disturbances, and a slight discharge from the ear. She had some cough, dyspnœa, and occasional pyrexia; no improvement had resulted from general treatment. At the time when the serum treatment was begun the child was miserable in appearance, wasted, with the muscles flaccid, the mucosæ pallid, the skin dry and scaly, the glands enlarged, breathing harsh at each apex, with sibilant râles, moist râles lower down; the abdomen tumid, and the liver and spleen below the costal margin, the latter slightly. The hæmoglobin was 50 per cent.; the red blood-corpuscles numbered 3,000,000; there was indicanuria, but no pyrexia; the child weighed 11·75 kilogrammes. The treatment included fifty injections. During the first fortnight there was some improvement in the general condition and appetite, with diminution of both dry and moist sounds and cough. The hæmoglobin was 65 per cent., and the red blood-corpuscles numbered 4,000,000. In the last three weeks of the treatment there was very slight pyrexia due to some slight local suppuration at the seat of injection, which subsided on the discharge of some pus. At the end of the treatment there was great diminution in the dry sounds, no moist being heard, with a decrease in the size of the glands: the hæmoglobin was 60 per cent.; the red blood-corpuscles numbered 3,624,000; there was no fever; the weight was 11·8 kilogrammes; the general condition was good; the appetite was fair; and the child was cheerful. The writer looks upon these cases as very instructive, showing as they do considerable improvement in the tuberculous condition, with marked change for the better in the general state of

the patient's health. They are also of importance in showing the harmlessness of the treatment. As these patients were both young and delicate children they would be expected to exhibit whatever bad effects might accrue from the method. The result was, however, only a slight local suppuration in one, and even that was practically insignificant in its effect.

Favourable results from the use of Maragliano's treatment have been reported by Regnier, Fasano, De Renzi, Casarini, and others. Fasano (cited in the *Archivio internazionale di medicina e chirurgia*, 1896; *New York Medical Journal*, October 31, 1896) employed Maragliano's serum in the treatment of pulmonary phthisis in the hospital of Sainte-Marie de la Paix. The patients were carefully watched by him every day and all forms of phthisis thoroughly studied. Maragliano's method was rigorously carried out in regard to the diet, the doses, and the time of injection, and the results obtained led the author to the following conclusions: 1. The serum is absolutely harmless and does not provoke lesions of the renal organs. 2. In certain subjects there are some cutaneous manifestations, but they disappear rapidly. 3. Occasionally the serum produces engorgement of the ganglia near the seat of injection, but this may be avoided by a rigorous antisepsis during the procedure. 4. The serum has certainly an antithermic power, which varies with the temperature and the amount of serum injected; the lower the temperature the smaller should the dose be; when the temperature is higher the dose must be increased; a thermic lowering is obtained with 5 cubic centimetres, but the fever does not entirely disappear until after from twenty-five to forty injections have been given, according to the individual. 5. The serum diminishes respiratory action and the frequence of the pulse, as it causes a moderated action of certain nervous centres. 6. It increases the weight, the dynamometric strength, and the appetite from the beginning of the treatment. 7. It increases respiratory power and invariably diminishes the sweats, and in certain cases causes their complete disappearance. 8. The direct changes of the bacilli take place slowly in the expectoration; in the pure forms—that is to say, without microbian associations—the disappearance and the diminution of the bacilli are more prompt, and when this condition occurs it is invariably maintained, and it is dependent upon not only the quantity of serum injected, but the duration of the treatment. 9. The daily quantity of the expectoration constantly diminishes. 10. In the forms in which râles prevail there is a drying of the bronchopneumonic centre and finally a disappearance of the râles. 11. The serum may be considered as a remedy for the local symptomatic processes in the extensive forms with fusion, cavities, and a high temperature, or as a curative in limited and initial forms. Dr. Fasano thinks that this serum is a remedy that all physicians should employ, especially in the beginning, when the results are more certain, as it prevents the spread of the disease.

Dr. Paul Paquin, of St. Louis, who has made a close study of the serum treatment of tuberculous disease, using a serum of his own preparation, has reported a number of cases in which patients affected with various forms of the disease have been either cured or notably improved. In a recent article (*New York Medical Journal*, October 24, 1896) he states that up to September 1, 1896, he has received reports, tabulated more or less accurately, of two hundred and twenty-five cases. He has, indeed, reports touching on more than four times that number which are not written so as to be available to make an absolutely reliable digest of them at the time of his writing. There are among them a number of records of improvements and some of alleged recoveries.

The details of conditions and results of the two hundred and twenty-six cases are as follows, foreign classification being employed to make comparisons of American and foreign work more intelligible:

Pulmonary tuberculosis:	No. of cases.
Class 1. Destructive bronchopneumonia and cavities	37
Class 2. Destructive bronchopneumonia, without recognisable cavities	66
Class 3. With diffuse febrile pneumonia, with or without a destructive process.	19
Class 4. With diffuse non-febrile bronchopneumonia, with or without destructive cavities	19
Class 5. With circumscribed febrile bronchopneumonia	35
Class 6. With circumscribed apyretic bronchopneumonia	13
Diagnosis not reported clear enough for classification	32
Hip-joint tuberculosis	2
Laryngeal tuberculosis	2
Ovarian tuberculosis	1
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In every one of these cases the diagnosis was verified microscopically. During the treatment of these two hundred and twenty-six cases the following conditions obtained:

Effect of serum on fever: Subsided, 60; reduced, 56; stationary, 26; not recorded, 84.

Effect of serum on night sweats: Subsided, 69; unchanged, 17; not recorded, 140.

Effect of serum on weight: Increased, 125; unchanged, 15; decreased, 27; not recorded, 59.

Effect of serum on strength: Increased, 154; unchanged, 9; decreased, 24; not recorded, 39.

Effect of serum on appetite: Increased, 114; unchanged, 15; decreased, 31; not recorded 66.

Effect of serum on local signs: Disappeared, 46; mitigated, 58; unchanged, 29; not recorded, 94.

Effect of serum on tubercle bacilli: Disappeared, 40; reduced, 103; altered, 7; not recorded, 76.

Effect of serum on general well-being, exclusive of the 40 cures: Improved, 145; unchanged, 9; not recorded, 32.

Number of recoveries that seem complete and permanent	40
Number of apparent recoveries with existing lesions *in statu quo*	3
Number of improved capable of performing usual duties	41
Number of improved to a lesser degree	69
Number of deaths reported	32
Number of cases disappeared from observation or under various treatments	41
	226

As to the pulmonary cases, the extent, stage, and importance of the conditions at the beginning of treatment were as follows:

	Cases in advanced stage.	Cases in early stage.
In Class 1 there were	20	3
" " 2 " "	33	6
" " 3 " "	12	0
" " 4 " "	9	0
" " 5 " "	12	3
" " 6 " "	7	1
	93	13
Not classified accurately enough for satisfactory description of the stage	115	

These ranged between the first and third stages, and belonged to various classes.

Now, it is needless to add, says Dr. Paquin, that many physicians who have used serum have not reported. It should be remembered, also, that from eighty to ninety-five per cent. of the patients who have so far consented to use serum are in the third and last stages of the disease, and therefore by no means fair tests of the value of the serum in earlier and purer cases of tuberculosis. Nothing, he adds, can cure the vast majority of advanced cases. His own cases were treated exclusively with serum, and the reports given cover only those of which he is reliably informed and the diagnosis of which was trustworthy. It is obvious, he says, that if we would give tuberculous patients all the chances possible of recovery, we must begin their treatment at the earliest possible moment, when the first slight symptoms appear, instead of depending exclusively on drugs and climate until it is too late for the help of organic and pacific treatment.

Maragliano's tubercle-antitoxine serum has been employed in the treatment of *lupus*. Terrill (*Gazzetta degli ospedali*, July 12, 1896; *Therapeutische Wochenschrift*, August 9, 1896) used it on two young subjects, one of whom had lupus of the foot and the other lupus of the hand. The first one received, in all, 107 cubic centimetres of the serum (at first 1 cubic centimetre every second day, then 5 cubic centimetres every third day); the second got 25 cubic centimetres (5 every third day), and was also treated topically with the serum. In each case the result was very gratifying, although a perfect cure did not take place. The infiltration subsided and the joints became movable. The local application of the serum was founded on its direct destructive action on the bacillus, as was shown by the healing of a *tuberculous anal fistula* after local injections of it.

Dr. Juan de Dios Carrasquilla, of Bogotá, has used a serum prepared by himself in the treatment of *leprosy*. His conclusions (*New York Medical Journal*, January 18, 1896) are as follows:

1. The serum treatment overcomes the an æsthesia more or less rapidly, in proportion t the extent and gravity of the lesions of th peripheral nerves. 2. It decolourizes the mac ules without obliterating them entirely; the become the seat of abundant desquamatio 3. It causes œdema to disappear rapidly i some cases, slowly in others; the skin retract becomes wrinkled, and finally returns to it normal state when the œdema has subside 4. The tubercles become flattened and softene and disappear, either by absorption, by desqu mation, or by suppuration, leaving marks t show their situation. 5. After suppuratin abundantly, the ulcers heal with marvellou rapidity and leave the skin sound. 6. Th scars of old suppurative lepromata become pal and tend to assume a level with the surroun ing skin. 7. The ulcerated mucous mem branes cicatrize rapidly, become decolourize like the cutaneous macules, and regain the sensibility, while the tubercles disappear. With the disappearance of the œdema and th tubercles and with the fading of the stains th countenance grows thin and loses its leonin aspect entirely. 9. The appetite is recovere together with the capability of sleeping, the is cheerfulness, content replacing the previou profound depression, and lost hope is regaine 10. From the first serum injection admini tered to the patient the morbific action of th *Bacillus lepræ* ceases, and no new manifest tion of the disease shows itself. This th author has invariably witnessed in the fiftee cases that he has treated.

In a subsequent communication to the N tional Academy of Medicine of Bogotá (*Ne York Medical Journal*, August 22, 1896) D Carrasquilla describes his method of obtainir the anti-leprous serum and his mode of er ploying it. He first bleeds a leper, choosir an adult whose general condition is fair good. The blood drawn varies in amou from 100 to 250 cubic centimetres. It is r ceived into a sterilized vessel and careful covered, kept away from the light, and, abo all, kept perfectly quiet. In from twelve twenty-four hours the superficial layer serum, that only which is perfectly limpid, removed with a pipette. If it has to be kept f some time before it is to be used, it is pass through a layer of powdered camphor co tained between two layers of cotton to preser it, and it is kept away from light and he Thus prepared, the serum is injected into animal that is refractory to leprosy, prefe ably a healthy young horse in good conditio Roux's method of procedure is employed. regard to this operation, says Dr. Carrasquil there are two points that are of the greate importance and at the same time difficult determine—the amount of serum to be i jected at one time and the interval that shou be allowed to elapse between the injectio His experience leads him to think that cubic centimetres is the proper medium do given at intervals of ten days. The horse

bled in from five to ten days after the last injection, preferably from the jugular vein. The Nocard-Roux process is followed for obtaining aseptic horse serum, and it is treated in exactly the same way as the human serum. The dose of the serum for use on the human subject is from 1 to 5 cubic centimetres, according to the strength of the serum, the constitution, age, and other circumstances of the patient, the period of the disease, etc., given subcutaneously. The locality to be preferred for the injection is that bounded by the iliac crest and a transverse line passing just beneath the trochanteric fossa, or, better still, just to the outer side of the trochanter major. Great care must be taken to make sure that the serum has not undergone any septic change. A full day should intervene between the injections. Febrile reaction follows in all cases, and the injection should not be repeated until this has subsided.

Others, such as Professor Kitasato, of Japan, have tried the serum treatment of leprosy, but it must be said that thus far its curative power has not been satisfactorily demonstrated.

In the treatment of *cancer*, Dr. S. Arloing and Dr. J. Courmont (*Province médicale*, May 23, 1896; *New York Medical Journal*, June 13, 1896) have employed both the normal serum of the ass and that of the same animal "immunized" by inoculation with epithelioma juice. Their conclusions are as follows: 1. Injections of the serum of asses which have been inoculated with epithelioma juice given in the region of malignant tumours are not alone capable of causing the disappearance of these tumours or even of preventing the generalization and the fatal issue of the disease. 2. They may be useful in bringing about a diminution in the size of the tumour for a short time, probably by a retrogression of the peripheral inflammatory zone. This action may be the origin of a temporary cure, if not of a definitive one, by making it possible to operate on a tumour which was "inoperable" before the injections. More frequently it causes the disappearance, for a short time, of the symptoms of compression, such as pain and œdema. The general evolution of the disease will sometimes be arrested for several weeks. 3. Ass's serum thus prepared appears to contain toxic substances which do not exist in the normal serum. These substances accumulate in the organism, so that at a given moment they cause symptoms of reaction (in the cancerous at least), such as œdema, purpura, various eruptions, etc., near the punctures or even at a distance. These symptoms appear after the fifth injection, and they disappear in a few hours or days. They are frequently accompanied by general symptoms, such as a rise in temperature, anorexia, insomnia, etc. At the fifteenth injection the patients refused to have the treatment continued. 4. With the normal serum of the ass, the same diminution in the size of the tumours is obtained, but the reactionary symptoms which follow the injections of the "immunized" serum are never observed. 5. Subcutaneous injections of serum may be given in the region of "inoperable" tumours if, by so doing, it makes an operation possible by freeing the neighbouring parts, or when the tumours are accompanied by pain or œdema due to compression. The normal serum of the ass is preferable to the "immunized" serum.

At a meeting of the Congrès français de médecine interne (*Gazette médicale de Paris*, August 29, 1896; *New York Medical Journal*, September 26, 1896) M. Dubois stated that he had introduced fragments of cancers taken from human subjects into the cellular tissue of animals and had obtained several tumours, the largest of which weighed between 17 and 18 ounces. The serum of these inoculated animals was then employed in three cases of cancer. In the first case there was non-ulcerative cancer of the breast in which the treatment led to an almost complete recovery after a period of forty-five days. The second case was one of epithelioma of the face, which subsided in thirty-nine days. In each case from 2 to 5 cubic centimetres of the serum had been injected in the region of the tumour every three days, and a few drops of alcohol with a very small quantity of iodine had been injected around the tumour in the second case. The third case was one of relapsing epithelioma of the upper lip, which was very much ulcerated and highly inflamed, and after twenty-three days of the treatment the progress of the tumour seemed to have been arrested, but it presented no tendency to complete recovery. From these facts M. Dubois concluded that the serum of animals inoculated with cancerous elements seemed to cure cancer by fibrous transformation. Its action was much more certain, he said, when it was employed in the beginning of the disease. He thought its employment presented no dangers, except in cases of extensive lesions.

M. Bard stated that he did not believe that the tumours which were obtained in the animals by inoculation were of a really cancerous nature; he thought that they were simply of an inflammatory sort and not true neoplasms. The local reaction produced in the animals did not prove that they had been influenced by the inoculated cancerous elements. Furthermore, he thought that the alcohol and iodine which had been employed in the second case might have had a local action which diminished that of the serum. Moreover, serum injections in the region of a tumour caused, in some cases, a local inflammation which was sometimes useful; therefore he did not consider M. Dubois's experiments conclusive.

Dr. J. Swiatecki (*Przeglad Chirurgiczny*, iii, 2, 1896; *British Medical Journal*, October 17, 1896) reports a case of cancer in which serum prepared by the method of Richet and Héricourt was used. The patient was a woman, aged forty, with a recurrent cancer of the breast. Portions of the tumour were removed and inoculated on two different occasions in a dog. Serum was afterward taken from this dog and injected in the pectoral region of the patient, where the tissues were hard and infiltrated, although the wound of the second operation, which had been skin-grafted by Thiersch's method, was healing well. After

four injections of 1 cubic centimetre each of serum the skin over the mass was less tense, the arm was less swollen, and one of the enlarged supraclavicular glands looked smaller and was distinctly less hard. After two further injections of serum an abscess formed under the skin above the tumour, and an attack of erysipelas of the arm, with somewhat high temperature, occurred. The abscess was opened, giving issue to a large amount of pus and *débris*, the products of necrosis of the tumour. The temperature then fell, and it was found that the tumour had almost disappeared and the glands above the clavicle had shrunk almost to half their former size; the patient was very weak, but felt well. Some days later considerable hæmorrhages occurred, and at the spot which was the source of bleeding a cancerous ulcer with exuberant red granulations was discovered. The swelling over the great pectoral became as large as a woman's breast and adhered strongly to the ribs, extending in the form of hard infiltration into the axilla; nodules developed in the subcutaneous tissue of the epigastric region, and new glandular enlargements formed in the supraclavicular fossa and in the opposite axilla. The patient was greatly emaciated and in a very feeble condition; the author, therefore, had recourse again to the serum, and after three injections of 1 cubic centimetre each the ulcer, which had attained the size of a florin, rapidly diminished by one third. After eight consecutive injections it had completely cicatrized. The principal tumour had diminished to half its former size, and the other nodules had also become smaller; the patient looked better and was stronger.

According to Dr. John Ruhräh, of Baltimore (*Medical News*, November 21, 1896), Richet and Héricourt's anticarcinomatous serum is made as follows: An osteosarcoma is thoroughly rubbed up with water in a mortar, and then strained through a cloth. This was injected into dogs and a donkey, and after about ten days they were bled. The serum was obtained in the usual manner. In April, 1895, Richet and Héricourt reported the results of their labours to the French Academy of Sciences. They had used the serum in two cases successfully, one being a recurrent costal osteosarcoma of about the size of an orange. After forty days of treatment with 3 cubic centimetres of serum a day, the growth had been absorbed, as had almost all of the cicatricial tissue. The second case was one of a tumour of the stomach, of about the same size, which also disappeared under treatment.

Subsequently, in October, 1895, says Dr. Ruhräh, the same authors reported the following results after having used their serum in a large number of cases: There is a diminution of pain and the cancerous ulcers dry up, assume a healthy, granular appearance, and in some cases attempt to cicatrize. There is also a decrease in the size of the growth and of the enlarged lymphatic glands, and the evolution of the case seems to be delayed. Unfortunately, after about two months of improvement, which takes place in four fifths of the cases, the disease breaks out afresh; new foci form and death ensues.

Dr. Ruhräh mentions a case of his own in which he used this serum with the same result. It is evident that we have not yet in the serum treatment a remedy on which we may rely in the treatment of cancer, but it is to be hoped that before long it may be so perfected as to become a trustworthy resource.

Dr. Ludwik Rekowski (*Gazeta lekarska; Deutsche Medizinal-Zeitung*, November 12, 1896) has treated cancer with the serum of animals that has been subjected to a course of injections of sodium arsenite. Traces of arsenic were found in this anticarcinomatous serum. It was used on two patients with cancer of the face, 10 cubic centimetres being injected subcutaneously twice a week for six weeks, and at the end of that time the author was satisfied that the patients' general condition had improved notably. What the ultimate results were is not stated.

The same gentleman has pursued a similar plan in the production of a serum for the treatment of *syphilis*, using mercury salicylate on the animals. In the antisyphilitic serum thus produced traces of mercury could be detected by means of chemical tests. It was injected into patients with tertiary syphilis in doses of 10 cubic centimetres every third day, and the results are represented as astonishing; as soon as after the third or fourth injection the gummatous lesions began to disappear and soon vanished completely.

Professor Boeck, of Christiania (*Archiv für Dermatologie und Syphilis*, xxxv, 3; *Wiener medizinische Blätter*, July 30, 1896), has experimented with the serum treatment of syphilis, using the fluid removed from the tunica vaginalis in cases of hydrocele in syphilitic men. He comes to the following conclusions: 1. The symptoms of the primary period are more rapid in their involution than under the expectant treatment. 2. The secondary symptoms are somewhat delayed. 3. They are decidedly mitigated, so that the rash is hardly noticeable and the affections of the mucous membranes are strikingly slight. 4. The general condition is speedily improved. 5. The stage of secondary eruption is shortened. 6. The treatment is the more effective the earlier it is begun. 7. Serum from a person in the tertiary stage is more efficient than that from a person in the secondary stage. Although, on the whole, the serum treatment is not so effective as the use of mercury and iodine, it is deserving of further trial and may be regarded as a useful auxiliary.

Tommasoli (*Giornale italiano delle malattie veneree e della pelle; Fortschritte der Medicin*, September 1, 1896; *New York Medical Journal*, September 26, 1896), who was among the first to treat syphilis with serum and analogous agents, divides his most recent experiments into three series. In the first, by a method which he calls *hydropotherapy*, he used the ascitic fluid of a person affected with syphilitic disease of the liver. This he employed upon seven patients in the secondary stage, most of whom had had no previous specific

treatment. The smallest number of injections given in any one case was eight, and the largest thirty-seven, in periods ranging from ten to fifty-seven days, and the total amount injected varied from 68 to 350 cubic centimetres. The largest single dose was 18 cubic centimetres. The fluid was obtained with all antiseptic precautions, and used either fresh or after being kept in sterilized vessels with the addition of a few drops of chloroform. The fluid was injected into the buttocks, and no serious mishap occurred in any case. In most of the patients, soon after the injection, there followed indisposition, headache, giddiness, etc., but they always subsided speedily; in some there was a slight elevation of temperature; in several the temperature rose and the weight increased during the treatment. No albumin was ever found in the urine. As to the effect on the disease, all that can be said with certainty is that no new symptoms made their appearance during the course of injections.

In the second method, or *galactotherapy*, he used the milk of two women who had secondary syphilis, latent in one of them. After proper cleansing of the nipples, the milk was pressed out and injected immediately into the muscles of the buttock. Out of seven patients treated by this method, one had gummatous syphilis, but all the others were in the secondary stage. The number of injections varied from three to thirteen, and the total amount injected into any one patient ranged from 30 to 100 cubic centimetres. Two of the patients in the secondary stage were decidedly improved; the others showed no change. The method was based on the observation that in other infectious diseases, such as tetanus and diphtheria, the antitoxines pass into the milk.

In the third method, termed *myelotherapy*, he employed large quantities of the spinal cord of the ox. He had previously seen syphilitics relieved of malaise and osteocopic pains by eating freely of ox marrow without specific treatment. In all, nine patients were treated in this way. Six of them had severe headache and pains in the bones and joints; two of the six had before been treated with the ascitic fluid; the four others had had no treatment. The three remaining patients showed fresh lesions of the skin and mucous membranes. The fresh spinal cord of the ox was given either in the form of balls having powdered licorice incorporated in them or in that of an emulsion with milk. The smallest amount given in twenty-four hours was 300 grains, and the largest was 1,500 grains. None of the three patients with fresh cutaneous manifestations showed any improvement. Of the six others, only three were kept under observation for a considerable length of time; at the end of ten days they were all relieved of severe sufferings and felt perfectly well. Of course, this method of treating the disease can not properly be called serum treatment; nevertheless, it is interesting in this connection.

Normal serum has been employed in the treatment of syphilis, but Dr. A. Lourier (*Journal des maladies cutanées et syphilitiques*, July, 1896; *British Medical Journal*, September 26, 1896), who has experimented with the serum of healthy horses, has found it absolutely useless.

The serum treatment of *Asiatic cholera* has been studied experimentally by Lazarus, Metchnikoff, Roux, Ransom, and others, and clinically by the Japanese physicians under the supervision of Professor Kitasato. Dr. Nakawaga (*British Medical Journal*, July 18, 1896) gives the following abstract of Kitasato's report of December 6, 1895:

"The inoculations for obtaining the antitoxic serum were begun in May, 1895, with cholera bacteria isolated from one of the earliest cases in the last epidemic. At the time the serum treatment was begun at Hiroo Cholera Hospital (August 6, 1895) the supply of the serum was therefore very limited, and what was used for injection in the beginning was not all of the desired strength. Nevertheless, some of the animals had already attained quite a considerable degree of immunity, and the efficiency of the serum of such animals is seen in the following experiments:

"1. Without entering into details of the experiments, it may be stated that for guinea-pigs 0·02 milligramme (0·0002 cubic centimetre) was sufficient to protect against the inoculation of several times the fatal dose of cholera culture—the serum and the virus being injected into the peritoneal cavity simultaneously. The guinea-pigs used in this as well as in all experiments mentioned in the report weighed from two hundred to three hundred grammes.

"2. If the serum is injected subcutaneously, the quantity required to obtain similar results was found to be considerably larger (0·02 cubic centimetre).

"3. To determine the antitoxic property of the serum, using the word antitoxic in the strict sense, experiments were made with the toxine obtained by warming the twenty-day-old cholera bouillon culture for twenty minutes, at the temperature of 131° F. The bouillon culture thus sterilized (the so-called 'toxine') was found to be fatal to guinea-pigs in the dose of 1·5 cubic centimetre when injected into the peritoneal cavity. The antitoxic serum was found to neutralize the effect of 2 cubic centimetres of sterilized bouillon when injected simultaneously into the peritoneal cavity in the dose of 0·2 cubic centimetre.

"Experiments for ascertaining the curative action of the serum were carried on in this wise: A number of guinea-pigs were inoculated with several times the fatal dose of the virus, so that the untreated animals died within twenty hours after such inoculation. At the expiration of each successive hour injections were made in some of the animals, and it was shown that those treated not later than seven hours after the inoculation of the virus were cured, while those in which the injections were made after the lapse of seven hours could not be saved by the serum. In other words, if injected during the first third of the entire course of the disease (thus experimentally produced) the serum can be considered curative.

"Two hundred and seventy patients suffer-

ing from cholera were admitted into the Hiroo Hospital, Tokio, from August 6 to November 10, 1895, and a hundred and thirty-eight died. Rate of mortality, 51·1 per cent.

"Anticholera serum was employed in a hundred and ninety-three cases only, owing to the fact that the supply of serum was inadequate to allow it to be used in all cases.

"The rate of mortality among Japanese in nearly all the previous epidemics, as well as that of the last epidemic, has always been about 70 per cent. Without claiming to draw, from a number relatively so small, the final conclusion that the serum treatment was attended with the reduction of 20 per cent. in the mortality statistics, it is evident at least that the result of the new therapy was not an unfavourable one. Moreover, there is reason to believe that with a sufficient supply of very efficient serum the rate of mortality can still be lowered.

"Subsidiary results of serum injections are similar to those of diphtheria antitoxine: 1. Urticaria (very common). 2. Arthralgia (observed in eighteen cases only). 3. Myalgia (observed in six cases only).

"Obviously there must be difference in the prognosis of each case according to the time which elapsed before the patient came under treatment.

"Three cases of cholera were observed in children under two years of age. A bacteriological examination, microscopical as well as cultural, was made in every case."

Serums for the protection of animals against *hog cholera* and *swine plague* have been obtained by Dr. Theobald Smith, Dr. Moore, and Dr. de Schweinitz, of the Bureau of Animal Industry (*New York Medical Journal*, September 5, 1896), by the use of products of the *Bacillus coli communis*.

The serum treatment of *typhoid fever* has hardly yet passed the stage of laboratory investigation, and therefore requires no further mention here.

In the *Indian Medical Record* for August 16, 1896, there is an editorial article embodying a sketch of the serum treatment of *rabies*, both preventive and curative, in which it is stated that Tizzoni and Centanni have succeeded in obtaining a most powerful antirabietic serum. This serum is furnished by sheep, which during twenty days are submitted to inoculations with the attenuated nervous tissue of rabid animals in the proportion of 0·75 gramme to each kilogramme of weight of the animal treated. They declare that one injection of their serum gives almost immediate immunity. As a preventive, they say, a drop and a half of the serum is sufficient to protect an animal 2 kilogrammes in weight inoculated an hour afterward with virus from the dog. As a curative means, the subcutaneous inoculation of a cubic centimetre is said to suffice, even eight hours after direct infection. This serum, they also say, can be dried and kept in bottles away from the light, and, so kept, will remain powerful for a considerable time. Roger (*loc. cit.*) thinks that the use of this serum should be preferred to that of the Pasteur treatment in cases in which it is necessary to act promptly, and he adds that since 1891 Babès has successfully employed the serum treatment of persons bitten by rabid wolves. (See vol. i, pages 82 and 84.)

Certain nervous and mental diseases have been subjected to serum treatment. At the recent French Congress of Internal Medicine (*Semaine médicale*, August 19, 1896; *British Medical Journal*, October 24, 1896) Mairet and Vires reported that they had injected serum taken from a patient cured of mania into two women suffering from *acute mania*. In one of them each injection was followed by the onset of marked drowsiness; the agitation afterward became as great as before. In the other case twenty similar injections were given, the dose being 5 cubic centimetres. Each injection was followed by a feeling of drunkenness, buzzing in the ears, and heavy, deep sleep. Distinct improvement, physical as well as intellectual, was the result of a first series of these injections; then the agitation became as bad as before. A second series of injections in doses of 20 cubic centimetres in the twenty-four hours was given. Similar symptoms followed the injections, but the improvement which resulted from them persisted, and finally the patient was completely cured. The authors admit that this result, which so far stands alone, may be nothing more than a coincidence; possibly also it might be explained by the improvement in nutrition brought about by the injections. Nevertheless, they think the hypnotic properties of the serum to be noteworthy.

According to information received by the French Colonial Minister, says the *Allgemeine Wiener Medizinal-Zeitung* (cited in the *Deutsche Medizinal-Zeitung* for October 5, 1896), Dr. Yersin, the discoverer of the plague bacillus, has established a bacteriological laboratory in Uha-Trang, on the coast of Annam, for the study of the serum treatment of the *plague*, and has taken the opportunity afforded by this year's outbreak of the disease in and about Hong-Kong to make a practical test of the efficiency of serum obtained from horses. The account is that he has employed the treatment in twenty-five cases of bubonic plague, twenty-three of which have been cured.

The serum treatment of *snake-bite* has been made the subject of special study by Dr. A. Calmette, of the Pasteur Institute in Lille. Dr. Calmette (*British Medical Journal*, October 10, 1896; *New York Medical Journal*, October 31, 1896) says that the venoms of different species of snake produce physiological phenomena which are in general alike. The only difference is in the local action of these venoms, and it is possible to separate artificially the substances which produce the local phenomena from those which cause bulbar intoxication. This dissociation can be effected by means of heat. If any venom in solution in water is subjected to a heat of 185° F. for fifteen minutes, the albumin contained in it coagulates, and the thermogenic substances are destroyed, while the toxicity of the venom itself is in no way affected. M. Phisalix and M.

Bertrand had previously demonstrated this fact as regarded the venom of the French viper. After heating to 185° F., and after filtration, all venoms produce the same effects, whether they are taken from viperine or from colubrine snakes. They differ only in the inequality of their toxic activity. All are equally destroyed by alkaline hypochlorites and by chloride of gold—substances which the author suggested (particularly hypochlorite of calcium in 1-in-60 solution) for local use in preventing the absorption of venoms.

Quite recently M. Phisalix, assistant in the Paris Museum, announced that he had succeeded in isolating a "vaccine" substance by filtering venom through a Chamberland filter. The animals in which this experimenter inoculated filtered venom did not die, and were found to be "vaccinated" against the inoculation of a fatal dose of unfiltered venom. The author has repeated these experiments with the greatest possible care, but the results which he has obtained are very different. When a solution of normal venom is filtered through Chamberland's apparatus much of it is held back by the porcelain, exactly as is the case with the microbial toxines. As a matter of fact, the lethal dose of filtered venom is two and a half times that of unfiltered venom. But if, before filtration, care is taken to precipitate the albumin in the venom by means of heat, it is found that the porcelain holds back scarcely any of the toxic substance. Animals are killed by the same doses of the solution before and after filtration. It follows, then, that if non-dealbuminized venom is less toxic after filtration than before, this must be due to the fact that the albumin adheres to the porous wall of the filter, and forms an actual dialyzing membrane through which the venom can pass only with the utmost difficulty. If this albuminous venom is filtered anew it will be found that the liquid which passes through the filter is much less toxic.

Animals which have survived filtered venom can tolerate some three days later a minimal mortal dose of venom without dying. They begin to be "vaccinated," just like those into which a dose of normal venom less than the mortal has been injected. In the author's opinion, therefore, there is no need to suppose that by heat or by filtration of venom there is, as Phisalix and Bertrand suppose, a dissociation of two substances—the one toxic, the other antitoxic—which are found together in normal venom. This hypothesis appears to him to be in no way justified, and it is absolutely certain that if venom the toxicity of which has been reduced by heat or by filtration is injected into an animal in a quantity sufficient to kill it, the course of events will be precisely the same as if it had received the dose of normal venom slightly inferior to that which would have caused death. In both cases and in the same time the animal acquires by this inoculation resisting power, which enables it, even after several days, to tolerate with impunity a quantity of venom sufficient to kill other animals of the same weight.

The serum of animals "vaccinated" against a very active kind of venom, as, for instance, that of the cobra di capello, is perfectly antitoxic in respect of the venom of all other kinds of serpents, and even, says the author, as he recently proved, in respect of that of scorpions. Dr. Calmette insists upon this statement because it has recently been contested by Dr. Cunningham, and he states that he is ready to repeat before a commission the experiments which he has made many times on this subject.

The best method of "vaccination" in large animals which are to produce antivenomous serum consists in injecting into them at first increasing quantities of the venom of the cobra di capello mixed with decreasing quantities of a 1-in-60 solution.

All the observations in which the kind of serpent has not been determined must therefore be regarded as doubtful. He has published a most conclusive case relating to an Annamite who was bitten in the hand by a cobra di capello at the bacteriological laboratory of Saigon, who was cured by a single injection of ten cubic centimetres of serum.

It is proved conclusively, therefore, continues Dr. Calmette, both by experiment upon animals and by the applications which have already been made in man, that we possess in antivenomous serum a specific remedy which is most efficacious in cases of venomous bites.

In the *British Medical Journal* for November 21, 1896, Surgeon-Major S. J. Rennie gives the following account of one of the first cases of snake-bite treated in India with Professor Calmette's antivenene serum: "About 6.30 P.M., on September 21st, a Hindu boy, aged eleven, son of a groom, was drawing water from a well, and in returning accidentally stepped on a snake, which bit him on the right foot, the foot being bare at the time. Two men were with him who both saw the snake, but were unable to kill it before it disappeared in the grass. They promptly bound the end of a pugaree tightly round the boy's leg, and, picking him up, ran with him to my quarters. Not more than three minutes elapsed from the time he was bitten until I saw him. The typical imprint of a snake-bite, with its two deep fang punctures and the crescentic row of small teeth marks between, was clearly seen on the inner side of the right foot. It being 'the hour at which men most do congregate at the club,' no fewer than five medical officers were on the spot in a few moments. I at once injected 8 cubic centimetres of Calmette's antivenene serum into the subcutaneous cellular tissue of his abdomen. At the same time Surgeon-Major Birt, A. M. S., treated the wounds and their immediate neighbourhood with a hypodermic solution of permanganate of potassium, after which they were carefully washed and dressed. The case was then placed under observation and seen from time to time during the evening, but the patient never had a bad symptom, and is now running about as well as ever he was."

The snake was not killed, and therefore, says Mr. Rennie, there might be an element of doubt as to the nature of its species. The

reptile, however, was clearly seen by both men who were with the boy, who gave an accurate description of it, and recognised it as a krait (*Bungarus cæruleus*), that most deadly and dangerous Indian snake. The characteristics also of the wounds were clearly those of a bite from a snake with fangs. Mr. Rennie's own personal observation led him at once unhesitatingly to conclude that the injuries were caused by a poisonous snake, and in this he was borne out by the unanimous opinion of the five medical officers by whom the case was seen, several of them of long and varied experience in India. Taking all these points into consideration there can, he thinks, be little doubt that the boy was bitten, and bitten savagely and deeply, by a krait, a bite from which under ordinary circumstances is necessarily fatal.

According to Roger (*loc. cit.*), Marchoux has obtained from the sheep a serum of which from 10 to 12 cubic centimetres, injected into an animal on the day after its inoculation with *anthrax*, will prevent its death, and he thinks it likely to prove no less efficient in cases of *malignant pustule*.

The Klemperers, says Roger (*loc. cit.*), were the first to employ serum treatment in *pneumonia*. Of thirty-nine cases treated by them and others, thirty were very decidedly mitigated, and in twenty-one the crisis occurred within one or two days.]

(See also under ANIMAL EXTRACTS AND JUICES, vol. i, pages 83, 84, and 85; also ANTITOXINES.)

AUSTIN O'MALLEY.

SESAME OIL, *oleum sesami* (U. S. Ph.), is the expressed oil of *Sesamum indicum*, used for the same purposes as olive oil. Dr. R. Stüve, of Professor von Noorden's division of the Municipal Hospital in Frankfort on the Main (*Centralblatt für die gesammte Therapie*, June, 1896; *New York Medical Journal*, August 1, 1896), after experimenting with sesame oil, reports on its use as a *substitute for cod-liver oil*. He employed it in all kinds of cases, several hundred in number, in which cod-liver oil was indicated. The patients were of all ages, from six months upward to old age, but the majority of them were children between four and fifteen years old weakened by acute infectious disease or by scrofula. As a rule, the amount of sesame oil given daily was from two to three tablespoonfuls, but in many cases it was twice as large. On account of its absolute lack of odour and its almost entire tastelessness, it was seldom necessary to use anything in the way of a flavour; a swallow of coffee or of cognac or a bit of bread was always sufficient. Many patients objected to the taste at first, but their repugnance was soon over.

The oil was particularly well borne generally, but it disagreed with a few persons, causing palpitation and nausea or vomiting in some and diarrhœa in others, so that its use had to be discontinued. On the whole, the author regards it as one of the best borne and most easily digested of fats. It will often agree, he says, in cases in which cod-liver oil is contraindicated, such as those of *phthisis with obstinate diarrhœa*, which sesame oil aggravates only in very few instances and mitigates in the majority by improving the patients' general condition. Not less favourable was its action in cases of *chronic intestinal catarrh* with habitual constipation and overproduction of mucus in the lower portion of the intestinal tract.

The oil was strikingly well borne in cases of disease of the stomach. Emaciated persons with *gastric catarrh*, *excessive acidity*, *ulcer of the stomach*, or *nervous dyspepsia* took daily from 1 to 2 ounces of sesame oil without experiencing any ill effect. In other patients with sensitive digestive organs the oil was well borne; above all, in those with acute fevers. Patients with *febrile pleurisy*, *septic fever*, and especially *typhoid fever*, even children, bore the oil well. In some cases it was used by subcutaneous injection, in doses of from 15 to 100 cubic centimetres.

Administered as a nutrient enema, sesame oil was not found to give good results; it would remain in the rectum for from twelve to twenty-four hours and then be expelled. The author thinks it would act better as a substitute for olive oil in the enemata treatment of *habitual constipation;* it is at least, he says, quite as good as olive oil for this purpose. Only the finest and purest sesame oil is suitable for medicinal use. The author has had the best results with an oil furnished by the firm of Speyer & Grund, of Frankfort.

SEVUM (U. S. Ph.), **SEVUM PRÆPARATUM** (Br. Ph.).—Mutton tallow (see FATS and TALLOW).

SHIKIMOL.—See SAFROL.

SIALAGOGUES are substances which increase the flow of saliva. They may not be employed for this specific purpose, and may effect this salivation as an incident of their administration. Therapeutic indications may demand the use of such drugs, however, such as great dryness of mouth or fauces, or they may be used to diminish congestion in the neighbourhood of the salivary glands or for the relief of pain in and about the mouth which is dependent upon hyperæmia of the parts. Public speakers and singers find it advantageous, at times, to employ a substance which will increase the salivary secretion; and after exhaustive efforts on the platform or stage, a sialagogue will frequently combat with success the hoarseness which follows.

Sialagogues act in two ways. They either stimulate the salivary glands directly or, after passing into the circulation, influence the secreting cells of the glands to abnormal activity. The former group may act mechanically or in a reflex way upon the chorda tympani or the sympathetic nerves; the latter group depend for their power upon their stimulating action upon the peripheral ends of the secretory nerves in the glands. A flow of saliva produced in a reflex way after the ingestion of a sialagogue may be caused by a number of other circumstances which stimulate salivary secretion—for example, pregnancy, the odour, sight, or recollection of savoury food, the influence of emotions or the thought of saliva.

The class of drugs under consideration may be roughly divided into two classes, the classification depending upon the mode of action. *Topical sialagogues* are those which have a direct action upon the secreting glands or evoke such action in a reflex way by the production of a hyperæmia in the vessels supplying the glandular structures. Under this group may be placed the *mineral* and *vegetable acids* and *their salts, alkalies, ether, chloroform, mustard, horseradish, ginger, pyrethrum, megereon, tobacco, cubeb*, and *rhubarb*. Ordinary chewing gum accomplishes the same purpose, but does so mechanically, as any foreign body in the mouth might do. *Slippery-elm bark, ulmus* (U. S. Ph., Br. Ph.), is also a pleasant sialagogue. *Cubeb* in the form of tablets or in that of the berries themselves is frequently used for keeping the articulatory organs moist during a public effort. *Pyrethrum* is probably the most frequently employed sialagogue for therapeutic purposes in *relaxation of the uvula, toothache*, and *congestive conditions in and about the mouth*.

General sialagogues are substances which produce the salivary flow by stimulation of efferent secretory nerves or their end plates. Such are *jaborandi*, the *compounds of iodine, mercury and its compounds, muscarine*, and *physostigmine*. Some nauseants, like *tartar emetic*, produce a flow of saliva by stimulation of the glands through the pneumogastric nerve. Jaborandi (and its alkaloid, pilocarpine), nicotine, physostigmine and muscarine excite salivation experimentally by subcutaneous injection after the severing of all nerves leading to the secretory glands; it is possible, therefore, that their action is partly central as well as upon the peripheral ends of the secretory nerves. *Mercury*, in all probability, has a twofold action in calling forth an increased flow of saliva: it influences the gland structures and exerts its influence in a reflex manner. Mercurial salivation is rarely evoked for therapeutic purposes, since it may become too intense. During the prolonged ingestion of *potassium iodide* the drug is usually to be found in the saliva and may easily produce salivation.—SAMUEL M. BRICKNER.

SILICA.—In his *Treatise on the Materia Medica and Therapeutics of the Skin*, Dr. Henry G. Piffard, of New York, mentions Battye's employment of finely powdered silica in grain doses for relieving the *pain of cancer*, and says that he himself has used triturations of silica, and has twice seen small *lupous ulcerations* heal during its employment. He refers also to Ellinger's recommendation of the use of fine sand rubbed on the skin in the treatment of *ephelis, chromophytosis, acne rosacea*, and *chronic eczema*.

Silica hydrata, or hydrated silica, is a jelly-like mass prepared for Dr. Piffard according to a process devised by Dr. Charles Rice, the chemist of the New York Department of Public Charities. Dr. Piffard has used this mass as a dressing for *chancroids, buboes*, and other *suppurating surfaces*, and he is satisfied that it exerts a decided control over *profuse suppuration*. "The bubo or other lesion under treatment," he says, "should be thoroughly packed with the silica, and the dressing renewed once or twice a day. As soon as healthy action is established, its use should be discontinued." Dr. Piffard's book was published in 1881; since then, few if any trials of silica as a remedy appear to have been reported. Now (May 22, 1896), in a note to the editor of this work, Dr. Piffard says: "I have nothing to add to my account of silica hydrata, except to caution against its too profuse or prolonged use. It will check suppuration more quickly than anything I know of, but, if used too long, devitalizes the tissues and results in extensive sloughing."

SILICATES. — A solution of *potassium silicate* or of *sodium silicate, liquor sodii silicatis* (U. S. Ph.), "soluble glass," occurs as a syrupy liquid, which is employed for making rigid bandages or splints for use in *fractures*, etc., where an easily removable appliance is desired. It is applied with a brush to an ordinary roller bandage in the same manner as starch, dextrin, etc., and ordinarily becomes sufficiently rigid to allow of considerable strain to be exerted upon it in the course of four or five hours. When it is desired to remove it, the application of hot water will soften it sufficiently to permit of the bandage being unrolled. Potassium silicate and the corresponding sodium salt, *sodium silicate*, have been employed internally to produce the constitutional effects of their bases and also as astringents and antiseptics, but have no particular virtues as such.

Magnesium silicate, or meerschaum, when powdered, has essentially the same properties as bismuth carbonate and subnitrate, and may be substituted for them.—RUSSELL H. NEVINS.

SILVER, *argentum, argentum purificatum* (Br. Ph.), in its metallic state, is considered inert, and its internal administration is limited to its occasional use in the form of silver leaf, *argentum foliatum* (Ger. Ph.), as a coating for pills, but as a material for certain surgical purposes it is very valuable. Its flexibility and toughness render it indispensable for probes and directors. Cannulas and styles used to prevent the closure of artificial openings in the soft tissues, as after operations on the lacrymal passage, or to restore the lumen of an occluded external auditory meatus, are preferably made of silver because it is smooth, non-irritating, non-corrosive in the secretions of the body, and not readily broken. Silver wire has been used very extensively for sutures, especially in certain gynæcological operations, but it is being superseded for this purpose to a large extent by other materials. Other instruments which are frequently or occasionally made of silver, either pure or sterling, are applicators, cannulas, catheters, ear specula, Eustachian catheters, and tracheotomy tubes. Silver is used to some extent for spectacle frames, but is much inferior to gold alloyed to a proper hardness. Its use has been advocated in the manufacture of trusses, because it keeps bright, is not affected by the perspiration, and will not soon wear out.

[Metallic silver has recently been credited with *antiseptic* virtues. Credé (*Deutsche Medizinal-Zeitung*, March 26, 1896) has satisfied himself that, when brought into contact with colonies of schizomycetes, it kills them without exerting any unfavourable action on the animal tissues. He says that aseptic *wounds* coated with silver foil remain aseptic for weeks at a time, and heal better than with any other dressing. Instead of silver foil, he has lately employed a dressing material in the fabric of which metallic silver is intimately blended in such a manner as to admit of its being cut or torn into any shape desired. There is also a dressing in the form of a mull containing powdered silver that may with advantage be substituted for iodoform gauze in packing deep wounds.]

A large number of salts of silver are known in chemistry, but very few are used in medicine. Those official in the U. S. Ph. are the cyanide, iodide, nitrate, and oxide. With the exception of the cyanide, which is used for pharmaceutical purposes only, all these salts resemble each other closely in their action, varying principally according to their solubility. All should be protected from the light, because in the presence of organic matter, even in the small quantity present in the air, light induces their decomposition. The nitrate is the most soluble and is used very extensively, while the others are seldom employed. The soluble silver salts are very considerably used in staining sections made for microscopic examination, on account of their strong affinity for the cement which unites epithelial or endothelial cells. They also unite with albumin to form albuminates, which are soluble in the digestive fluids, but it is not certain that this is the form in which silver is absorbed into the system. According to Fraschetti, a reduction of the salts takes place in the stomach, afterward in the intestinal canal, tending to the separation of the metal. The same writer says that silver finds its way to the organs of the body through the lymphatic passages. In medicinal doses, a soluble salt of silver acts as a *tonic to the nervous system*, causes certain changes in the blood, and increases tissue change and the secretion of bile; in larger doses it depresses the heart, reduces the temperature, and causes embarrassment of the respiration; in an overdose it acts on the central nervous system to produce tetanic convulsions or paralysis.

The prolonged internal use of any of the soluble salts of silver will occasion *chronic silver poisoning*, known as *argyria*. The first sign of this condition is the appearance of a slate-coloured line along the gums, associated with some inflammatory swelling. Subsequently grayish patches appear on various parts of the skin and mucous membranes, and spread until the whole integument has become dingy or slate-coloured. No organ of the body, save the parenchymatous cells and the epithelium, is excepted from this pigmentation, which is due to the deposit of silver, either in its metallic state, or as an oxide, or as some organic compound. Although several months of ingestion of silver elapse before the discoloration can be seen, the deposit of the metal probably takes place proportionally from the first dose. As a rule, argyria does not produce any serious effect upon the health of man, but some writers ascribe to it gastro-intestinal catarrh, faulty assimilation, fatty degeneration of the heart, liver, and kidneys, and changes in the blood. Such associated conditions form a part of argyria in the lower animals, and their occasional appearance in man is not a matter of surprise. It is not improbable that in all cases a certain, though not serious, degree of derangement of nutrition is present.

A local argyria, or argyrosis, may be caused by the frequent topical application of a soluble silver salt for a considerable length of time. Thus, the conjunctiva is not infrequently seen to be discoloured from the prolonged use of nitrate of silver. A few cases have been reported in which general argyria has resulted from the topical use of silver, usually in the mouth or throat.

The elimination of silver from the body is accomplished very slowly and in a manner which is not known. It is generally supposed to be removed in the albuminous secretions, such as the bile, and, as it has been detected in the urine, it is possible that it may be eliminated by the kidneys to a very slight extent. Fraschetti denies that it is eliminated by either the kidneys or the intestines. At best, the process of elimination is very slow and the discoloration of the skin and mucous membranes in argyria may be considered permanent, although a few cases have been reported in which it disappeared after long courses of treatment with *iodide of potassium*.

In order to avoid the unpleasant production of argyria in any case where the internal use of silver is indicated, its administration should not be continued longer than from six to eight weeks, and then the use of the drug should be stopped and the patient given a thorough course of purgatives, diuretics, and baths. The iodide of potassium may be given with the silver to expedite its elimination, and the patient may be frequently sponged off with a solution of *hyposulphite of sodium*.

Silver nitrate, *argenti nitras* (U. S. Ph., Br. Ph.), *argentum nitricum* (Ger. Ph.), is by far the most important of the silver salts, viewed from a medical standpoint. It is described in the U. S. Ph. as occurring in "colourless, transparent, tabular, rhombic crystals, becoming gray or grayish-black on exposure to light in the presence of organic matter, odourless, having a bitter, caustic, and strongly metallic taste and a neutral reaction. It is soluble in 0·8 part of water and in 26 parts of alcohol at 15° C. (59° F.), in 0·1 part of boiling water and 5 parts of boiling alcohol. When heated to about 200° C. (392° F.) the salt fuses to a faintly yellow liquid, which, on cooling, congeals to a purely white, crystalline mass. At a higher temperature the salt is gradually decomposed with evolution of nitrous vapours. It should be kept in dark, amber-coloured phials, protected from the light."

If hydrochloric acid or a soluble chloride is

added to a solution of nitrate of silver, a white, curdy precipitate is formed which is soluble in ammonia. If a small piece of the crystal is heated on charcoal by means of a blowpipe, it melts and then deflagrates, leaving behind a dull metallic coating.

For topical purposes, it is fused and moulded into pencils, of which two strengths are official in the U. S. Ph., the lunar caustic and the mitigated caustic. The moulded silver nitrate, or lunar caustic, *argenti nitras fusus* (U. S. Ph.), is made by melting the crystals with 4 per cent. of hydrochloric acid and casting in suitable moulds to form "a white, hard solid, generally in the form of pencils or cones, of a fibrous fracture, becoming gray or grayish-black on exposure to the light in the presence of organic matter, odourless and having a bitter, caustic, and strongly metallic taste." This conversion of a small portion of the nitrate into chloride of silver is for the purpose of giving a certain degree of toughness to the pencils, which, when made of the pure nitrate, are very brittle.

The mitigated caustic, *argenti nitras dilutus* (U. S. Ph.), *argenti et potassii nitras* (Br. Ph.), *argentum nitricum cum kalio nitrico* (Ger. Ph.), is composed of 1 part nitrate of silver and 2 parts nitrate of potassium melted together and cast in moulds. The pencils closely resemble those of lunar caustic, but have a finely granular instead of a fibrous fracture. Both forms are *stimulant*, *astringent*, and mildly *caustic* in their action, but the mitigated is much weaker, and is to be used where a gentle effect is desired. The moulded nitrate may cause sloughing or ulceration if used too energetically. Both forms should be kept and used in a protective covering, such as a porte-caustique.

The nitrate is the most freely soluble of the silver salts. It has a strong affinity for albumin, with which it unites to form an albuminate. Locally applied, it causes a very marked contraction of the blood-vessels, and is in consequence an efficient *hæmostatic*. In weak solutions it is an astringent, and when applied to a mucous membrane it whitens the surface by uniting with the albumin. In stronger solutions it is an irritant and acts as a superficial caustic by coagulating the albumin of the tissues to which it is applied and destroying their vitality. At the same time this change results in a dense layer which prevents further penetration of the salt into the tissue and so limits its caustic action. The albuminous coating thus formed is at first white, but under the influence of light soon becomes black. This decomposition of nitrate of silver which takes place under the influence of light in the presence of organic matter is made use of in the manufacture of indelible ink, but is a frequent source of annoyance to a surgeon on account of the accidental stains on his hands and clothing. The writer has for several years been accustomed to bathe his hands with a solution of salt and water immediately after the use of this drug, and has found it very satisfactory to prevent the appearance of stains upon them. It must be used before the chemical reaction has taken place, which fortunately is not rapid, in order that the silver present may be changed into the insoluble chloride. After the black stains have appeared, and while they are still recent, they may be removed by washing with a solution of cyanide of potassium. A number of preparations have been recommended for this purpose, two of which are the following:

℞ Potassium cyanide..... 9 parts;
Iodine..... 1 part;
Water..... 96 parts.
M.

℞ Corrosive sublimate..... 10 parts;
Ammonium chloride..... 10 parts;
Distilled water..... 80 parts.
M.

When the stains are older, an efficient method of removal is to rub them with a mixture of iodine and ammonia, and while the part is still wet wash it thoroughly with water. The vessel in which this preparation has been made must also be washed without delay, because the compound produced when the mixture is allowed to dry is apt to explode upon slight agitation.

Nitrate of silver, given internally in small doses, is said to stimulate the heart, promote nutrition, and act as a nerve tonic. Large doses produce violent gastro-enteritis, thrombosis of the gastric veins, and ulceration of the mucous membrane of the stomach. It also causes centric impairment of the nervous system with loss of the power of co-ordination, paralysis, convulsions, coma, disturbances (and finally paralysis) of respiration, from which death results. The lethal dose is not certain. The antidote is *chloride of sodium* in large quantities. Vomiting should then be induced at once, as the chloride of silver is soluble in solutions of chloride of sodium and in the digestive fluids, or, if possible, a very soft stomach-tube should be introduced and the stomach very thoroughly washed out with salt and water. The same precautions must be observed in the use of the stomach-pump in these cases as in cases of poisoning with other corrosive agents. If the stomach can not be washed out, large draughts of salt and water must be taken and vomited, and this repeated until no silver remains. The stomach should then be filled with milk and the bowels moved with oil.

For internal use, the crystals should always be prescribed, and the long list of chemical incompatibles be borne in mind when choosing an excipient. This list includes all soluble chlorides, most of the mineral acids and their salts, alkalies and their carbonates, and organic material. In spite of the most careful choice of an excipient, it is doubtful if the drug ever reaches the stomach as nitrate of silver, and if it does it is probably changed immediately upon its arrival. The usual dose is from $\frac{1}{6}$ to $\frac{1}{4}$ a grain, three times a day.

The internal use of nitrate of silver is almost confined at present to affections of the gastro-intestinal tract. Probably on account of its

astringent action it is sometimes very useful in cases of *irritable stomach*, to allay *persistent vomiting*, in *chronic gastric catarrh*, and in *gastric ulcer*. When given for stomach trouble, it should be administered when the viscus is empty.

[Forlanini's method of treating *chronic gastritis* by irrigating the stomach with a solution of silver nitrate has been employed in twenty cases by Reale (*Riforma medica*, iv, 1895, No. 37; *Deutsche Medizinal-Zeitung*, April 13, 1896), who reports that in eleven of them the influence of the treatment on the chemistry of the stomach was investigated. Of the eleven patients, nine had chronic catarrh, mostly accompanied with a reduction of the amount of hydrochloric acid in the gastric juice; in one of them abnormal fermentation was enormous. In one of the patients, who had been assumed to have chronic gastric catarrh, cancerous stenosis of the pylorus was found after death.

At first the irrigations were performed with a solution of about 3¾ grains of silver nitrate in a little over 5 drachms of water. The strength of the solution was gradually increased, but not to exceed 22 grains to the amount of water mentioned. The best results were obtained with these doses, which were rather large as compared with those recommended by Forlanini. Immediately after the use of the silver nitrate the stomach was irrigated with a solution of from three to five per cent. of common salt.

The results were as follows: The first thing observed was a heightened motor activity of the stomach, as was shown by the amount of decrease in the contents of the organ in the course of an hour after a test meal. This was accompanied by an increase in the secretion of hydrochloric acid. In all cases the *vomiting* was checked speedily and permanently and the general nutrition was promoted, for the patients gained in weight and in muscular power.]

Silver nitrate is also at times of value in *chronic inflammation of the small* and of the *large intestine*, particularly when associated with *ulceration*. In *ulcers of the rectum* situated so as to admit of its local application it is of especially good service. It has been said to give relief to pain in *catarrh of the biliary ducts* and to assist in restoring the functional activity of the liver. It has also been recommended in *cholera infantum* after the acuter symptoms have abated, and it has done good service in some epidemics of *acute dysentery*. Formerly it was used as a *nervine tonic* in *epilepsy*, but has been superseded by other remedies which are less objectionable and more efficacious. Its use in *spinal sclerosis*, *labio-glosso-laryngeal paralysis*, and other similar diseases has not been marked with much success, but it is said to be one of the few remedies which are ever of any service in *tabes dorsalis*.

[Dr. William Murray, of London (*Lancet*, September 21, 1895), says that, as regards the treatment of *epilepsy*, it is evident that our efforts must be directed to the removal or prevention of the tendency to an explosive discharge in the nervous and muscular systems. Without attempting to explain, he says, how this inhibited state of the nerve centres is brought about by several remedies, some of them do their work by preventing this explosive union of atoms or molecules. One of these remedies—nitrate of silver—offers a fair field for study in this direction. Some years before, he says, he expressed the opinion that a deposit of silver in some form, probably chloride, in the molecules or submolecules of the nerve cells and fibres so altered the polarity—that is, the explosive tendency—of the molecules as to arrest the epileptic discharge. Dr. Gowers, he says, gives a mental picture of what actually takes place in the action of the nervous and muscular tissues when force is set free. He points out that the susceptibility to nervous and muscular action needs but the influence of a stimulus to bring about a manifestation of the latent energy in these tissues, and that an increase of susceptibility or of stimulus may evoke an epileptic explosion. The inference is, says Dr. Murray, that a remedy which is deposited in the tissues may by its chemical inertia interfere by its presence with the minute motion or chemical activity of adjacent atoms and thus prevent their explosive union. Experience has taught us two remarkable things, he says: First, that nitrate of silver will cure epilepsy where the bromides have utterly failed; secondly, that a patient who has subjected himself to a course of silver that has produced a deposit secures a remarkable immunity from a number of *minor nervous ailments*. This latter effect, he says, throws a great deal of light upon the subject and corroborates the view that the silver blunts the polarity of the nerve centres and renders them stable and less easily disturbed by outward influences. In confirmation of these statements and in proof of the power of nitrate of silver to cure epilepsy, he relates a few cases.

With regard to the effect of nitrate of silver in minor ailments, he says, there is no more striking illustration of it than in those cases of *weak, irritable stomach* which are characterized by intense *depression of spirits*, apprehensions, and failure of pluck or courage. In these cases a remarkable change takes place both in the functions of the stomach and in the tone of the nerve centres of emotion. To get the best results in these stomach cases, the nitrate should be dissolved in distilled water and taken on an empty stomach. Dr. Murray thinks that a distinct local effect on the mucous membrane, as well as the more remote effect on the nerve centres, by giving it in this form, is produced.]

The local uses of nitrate of silver, which are the more important, depend on its antiseptic, hæmostatic, astringent, and caustic properties. As an *antiseptic*, it has proved an efficient prophylactic measure against *ophthalmia neonatorum*, when used in a manner suggested by Credé, by instilling a drop of a 1- or 2-per-cent. solution into each eye of a newborn infant. Bad results do not frequently occur from this rather heroic means of prophylaxis, but Pomeroy has reported a case in which persistent

hæmorrhage from the conjunctiva was excited by it. It is preferable to restrict the use of this method to those cases in which the mother is known to have a blennorrhœal discharge, and in other cases to thoroughly cleanse the eyes of the child with a solution of bichloride of mercury, boric acid, or common salt.

In *ophthalmia neonatorum*, when the discharge is distinctly purulent, a solution of nitrate of silver from 1 to 2 per cent. in strength should be applied daily to the conjunctiva. When the discharge is very profuse, particularly if the gonococci are abundant, the 2-per-cent. solution will not be too strong. A very important part of the treatment of this disease is to keep the eyes carefully and continuously cleansed.

In the *purulent conjunctivitis* of adults, after the tense conjunctiva has become soft and velvety, the lids should be everted daily, the conjunctiva cleansed and then dried with absorbent cotton, and a solution of nitrate of silver brushed over the surface with cotton on an applicator. The strength of the solution may vary from 1 to 4 per cent., but a 2-per-cent. solution is perhaps the most commonly employed. After this application the excess of nitrate should be removed, either by washing the conjunctiva with warm water, or by neutralization with salt and water. When the cornea is intact, solutions ½ to ¼ of 1 per cent. in strength may be occasionally dropped into the conjunctival sac. Care must be exercised in all cases in which nitrate of silver is used in diseases of the eye that it shall not come in contact with an inflamed cornea, as it is then not well borne and may cause a permanent opacity from a deposit of silver. Milder methods of treatment have almost superseded the use of silver in catarrhal conjunctivitis, except in some chronic cases.

In *trachoma* the application of silver nitrate is one of the oldest methods of treatment, and still has its pronounced advocates, though other methods have been largely adopted, and it can no longer be said to be the favourite. The mitigated stick presents the advantages of being capable of a localized application and of being at the same time more efficient than solutions. The latter are used in strengths varying from 1 to 4 per cent., according to the condition of the conjunctiva.

Otherwise intractable cases of *dacryocystitis* are not infrequently quickly cured by the injection of a few drops of a solution of this drug into the lacrymal duct, but such a practice is not to be commended as a routine treatment.

In obstinate cases of *blepharitis marginalis* a good result is sometimes obtained by removing all the eyelashes and scabs and then applying the fused caustic to the margins of the lids.

The *eczematous eruptions on the lids* which not infrequently accompany strumous eye affections may often be benefited by the application of a moderately weak solution.

In *chronic purulent inflammation of the middle ear* nitrate of silver is one of the most valuable agents at our command. It has been used in solutions varying in strength from ½ of 1 per cent. to saturation, dependent upon the conditions present in the ear and the experience and judgment of the surgeon. The auditory canal should be thoroughly cleansed and dried, and the application then introduced either directly into the middle ear, by means of a syringe made for this purpose, through the perforation in the tympanic membrane, or by means of cotton on an applicator, or by dropping it into the external meatus. A very neat method of making applications is to fuse a small quantity of the mitigated or of the moulded caustic on the end of a silver probe or applicator, to which it adheres very firmly, and so carry it to the desired spot. *Aural polypi* are sometimes successfully treated with solutions of from 6 to 20 per cent.

Weak solutions are frequently useful in *eczema of the external ear* and in *external otitis*. Silver nitrate has also been recommended for *chronic inflammation of the mucous membrane lining the Eustachian tube*, but it is seldom used. It has also been alleged to abort *aural furuncles* when applied in the first stage, and to relieve *pruritus of the external auditory meatus*.

In the local treatment of diseases of the nose and throat, nitrate of silver, though occasionally useful should be employed with care, as it may be decidedly harmful. It is an excellent hæmostatic, and will often check an *epistaxis* dependent on an ulcer of the nasal mucous membrane. *Ulcers on the nasal septum* are quite common, as results of both mechanical irritation and disease, and a very good treatment for them is to thoroughly cleanse their surfaces and then apply an 8- to 12-per-cent. solution. This promotes healing by its astringent and stimulant action, but such an application should not be made too frequently.

The *vascular granulations* which often occur after operations in the nose are advantageously treated by touching them with the moulded nitrate or with a strong solution in the same manner as *exuberant granulations* are treated elsewhere in the body.

In *acute coryza* a powder made by triturating nitrate of silver with some inert substance will relieve the immediate symptoms by means of its astringent action.

In *chronic inflammation of the nasal mucous membrane* nitrate of silver, though not generally useful, is occasionally of decided value. In an old case of *atrophic rhinitis*, or *ozæna*, after the scabs have been removed and the mucous membrane has been thoroughly cleansed, an application of a moderately strong solution is sometimes of benefit, but these cases have to be carefully selected. *Fissures of the lips* and *tongue*, *mucous patches*, and *ulcers of the mouth* respond well to this treatment. It is of doubtful value in *chronic pharyngitis* or *naso-pharyngitis*, but it is occasionally useful to abort an acute attack. Its use on *adenoids in the naso-pharynx* is to be deprecated, as it does no good and is apt to cause considerable pain.

A threatened attack of *amygdalitis* may perhaps sometimes be aborted by the application of a strong solution, but when it fails

its irritant action increases the severity of the inflammation. *Diphtheria* and *membranous croup* are not usually benefited by the local use of this drug. It exerts no influence toward the removal of recent exudations, and is apt to irritate and increase the trouble present. It should never be used in infancy.

In *chronic* and *subacute laryngitis* the application of a solution of nitrate of silver is sometimes very effective. The strength used varies from 0·1 to 12 per cent., according to the conditions present. It should be very carefully applied to the affected portion after cleansing with an alkali and anæsthetizing with cocaine. But there is great danger of provoking a severe laryngeal spasm in making such an application, and two precautions should always be taken—to avoid touching the epiglottis, and not to use any excess of the fluid. In the treatment of *laryngeal ulcers* this drug is efficient, but it is of little use in laryngeal phthisis. Sponging the throat with a solution of moderate strength is said to give a decided amount of relief in *whooping-cough*, but the primary effect is a violent paroxysm of coughing.

In making applications to the mucous membrane of the mouth and throat, the danger of fracture of the brittle stick of caustic, of the broken portion being swallowed, and of consequent acute poisoning must be remembered and guarded against. A good plan is not to use the official pencils, but to fuse a small portion on a silver probe, in the manner already mentioned, which may be used without danger of any portion becoming detached. It should also be borne in mind that cases of general argyria have been reported as resulting from the prolonged topical use of nitrate of silver in the mouth and throat.

In general surgery, the moulded nitrate is largely used to cut down *exuberant granulations* in suppurating wounds, and to stimulate *indolent ulcers* to repair. It should be freely applied in the former case, but in the latter the surface should be only gently touched. A good plan is to trace a line with the caustic on the surface of the ulcer, parallel with and a little distance from the margin of the integument, and to repeat this every day or two as this margin creeps inward.

In punctured wounds and dog bites it is irritant and should never be used. It has no effect whatever as a preventive of rabies. In the treatment of *fissured nipples* the mitigated caustic is sometimes very useful.

In some inflammatory conditions it is employed as a counter-irritant, but is little, if any, more efficient than tincture of iodine.

In genito-urinary surgery, nitrate of silver is an old, tried, and valued remedy for *gonorrhœa*, to be applied to the urethra during the course of the disease. In the early stage it is used to abort the inflammation, a treatment which has strong advocates and equally strong opponents. One point should be seriously considered before trying the abortive treatment in any case—if it fails to cut the inflammation short, it will probably aggravate it considerably. It is also frequently a useful remedy in *gleet*, *prostatorrhœa*, *balano posthitis*, *hæmaturia*, and *chronic cystitis*.

Cordier recommended and reported excellent results from the injection of a 2-per-cent. solution into the substance of *buboes* in their early stage. *Indolent sinuses* which result from buboes, or from abscesses elsewhere in the body, may be stimulated to healing with a strong solution or the moulded caustic. It is sometimes applied also to *venereal sores*.

Formerly it was used much more than at present for *cervical endometritis* and *erosions of the os uteri*.

Cysts and *hydroceles* may also be cured by the injection of a solution after evacuation of the contents. An adhesive inflammation is set up which obliterates the sac. Other methods of treatment are usually preferred, however.

A 2-per-cent. solution, painted on the skin when it is red but not yet broken, hardens the epidermis and is frequently efficient to prevent the formation of *bedsores*.

In *erysipelas*, the method of treatment suggested by Mr. Higginbottom in 1828 is said to be very successful when the directions laid down by him are properly observed, but at the present time other methods are largely employed. His directions are: "The affected part should be well washed with soap and water, then with water alone, to remove every particle of the soap, as the soap would decompose the nitrate of silver; then to be wiped dry with a soft towel. The concentrated solution of four scruples of the nitrate of silver to four drachms of distilled water is then to be applied two or three times on the inflamed surface and beyond it, on the healthy skin, to the extent of two or three inches." He maintained that if the inflammation should spread it would be less severe, and might eventually be checked by repeated applications.

In diseases of the skin nitrate of silver is used to destroy parasitic fungi, to cause exfoliation of the epidermis, or for a stimulant effect. As a caustic for destroying outgrowths of the skin, such as *warts* and *molluscum contagiosum*, it is inferior to several other caustics. It is useful in some forms of *eczema*, relieves the *itching* in *prurigo* and *lichen*, and is said to prevent pitting in small-pox. Its use has also been recommended in *lupus*, *psoriasis*, *erythema*, and *ringworms*.

Silver cyanide, *argenti cyanidum* (U. S. Ph.), has no medical use, and is official simply for the pharmaceutical purpose of the manufacture of hydrocyanic acid. The toxicology of this salt is that of hydrocyanic acid rather than of silver.

Silver iodide, *argenti iodidum* (U. S. Ph.), is described as a heavy, amorphous, light-yellowish powder, unaltered by light if pure, but generally becoming somewhat greenish-yellow, without odour or taste, and insoluble in water, in alcohol, in diluted acids, or in solutions of carbonate of ammonium, soluble in about 2,500 parts of stronger water of ammonia.

This salt was introduced into medicine in the hope that thus silver could be used for internal medication without danger of discolora-

tion of the skin, but it has failed to realize this hope. It has been used in *gastric troubles*, *dysmenorrhœa*, and *epilepsy* in doses of from 1 to 2 grains for adults and $\frac{1}{8}$ to $\frac{1}{4}$ of a grain for children. It has been used for *trachoma*, but its use has never received much favour.

Silver oxide, *argenti oxidum* (U. S. Ph., Br. Ph.), is a heavy, dark, brownish-black powder, liable to reduction by exposure to light, odourless, having a metallic taste, and imparting an alkaline reaction to water, in which it is very slightly soluble. It is insoluble in alcohol. This salt is easily decomposed and parts readily with its oxygen, hence it must not be triturated with oxidizable materials. A case is recorded in which pills of oxide of silver, hydrochloride of morphine, and extract of gentian exploded violently in the pocket of a patient. When 29 grains are heated to redness the oxygen passes away and leaves 27 grains of metallic silver. It is the least irritating of the official salts of silver, and does not discolour the skin so promptly as the nitrate, although eventually the result is the same.

It allays *irritability of the stomach* and tends to check *vomiting* even in severe *gastritis*, and may serve to control *diarrhœa* dependent on reflex nervous irritation. It has been used with more or less success in *gastric neuralgia*, *irritable dyspepsia*, *pyrosis*, *gastric* and *pulmonary hæmorrhages*, *dysmenorrhœa*, and various other uterine complaints, and also to check *profuse sweating*. The usual dose is from $\frac{1}{4}$ to 2 grains, in pill or capsule.

For external application to *venereal sores* and to the urethra in *gonorrhœa*, an ointment has been used composed of 5 or 10 grains to the drachm of lard.

Silver and sodium hyposulphite.—This non-official salt of silver is used to some extent in medicine. It is very soluble in water, does not coagulate albumin, and may be given either by the stomach or hypodermically. It was first introduced for use in *diseases of the throat* as being superior to the nitrate in that it was more agreeable to the taste, and did not stain the skin or the clothing. It has also been used to some extent in *locomotor ataxia*. The dose to be given by the stomach is from $\frac{1}{4}$ to 3 grains; hypodermically, from $\frac{1}{6}$ to $\frac{1}{4}$ of a grain during the day.

Argonin is the name given to a combination of silver with casein introduced by Röhmann and Liebrecht. The amount of silver contained in it seems a little doubtful, as statements are made which indicate that it contains from $\frac{1}{15}$ to $\frac{1}{4}$ as much as is present in the same weight of the nitrate. It is soluble in water, non-irritant, and not precipitated by chloride of sodium from its solution. In the conjunctival sac it is no more irritating than water, but it is said to produce good effects in *purulent* and *catarrhal conjunctivitis*. It is also said to be antagonistic to the gonococcus, and is at the present time being recommended as a useful remedy in *gonorrhœa*. It does not stain the hands, linen, or clothing, and is asserted to show its *antiseptic* properties even in the presence of albuminous fluids.

[Silver lactate.—Credé (*loc. cit.*) says that numerous experiments have shown that silver forms a lactate with the lactic acid produced in the metabolism of the micro-organisms, and that this compound kills them. Therefore it occurred to him to make direct use of silver lactate, instead of silver in the metallic state, as an *antiseptic*. This preparation, known by the trade name of *actol* or *aktol*, he thinks fulfills all the requirements of an antiseptic better than any other. He has given as much as 15 grains of it subcutaneously without the least ill effect; there was only a slight burning pain at the site of the injection, lasting for but a few minutes. Silver lactate, he says, forms no insoluble compounds with the alkaline secretion of a wound or with tissue juice, as, for example, corrosive sublimate does, but only soluble ones, which gradually permeate the tissues and thus extend their action to some distance from the surface.

In a subsequent article (*Centralblatt für Chirurgie*, October 24, 1896; *New York Medical Journal*, November 21, 1896) Credé sums up his method of treating wounds as follows: Whether they are to be closed or to remain open, he covers them with silver gauze and dusts itrol (silver citrate) over any punctures that may be found. This gauze, containing metallic silver in a state of the very finest division, he says is absolutely unirritating and may be sterilized, but he does not consider that necessary. It becomes antiseptic as soon as morbific germs attack the wound, for the lactic acid which the germs produce unites with the silver to form the lactate. He cleanses the wounds with soap and water and a brush, applies ether to the surrounding parts, and rinses the whole with boiled water. If portions of tissue are almost completely separated, he removes them, but leaves large undermined flaps alone, also all fissures, opened joints, etc., and powders the surface of the wound lightly with itrol. If inflammation has already set in, he employs a water dressing for a few days; if not, he applies the silver gauze, lays cotton over it, and puts the injured limb at rest in a secure attitude. If the dressing becomes partially soiled by the oozing of blood and serum, he seeks to promote drying by putting on more cotton, more for the sake of appearances than for anything else. If the discharge is very great, he renews the upper layers of the dressing. He does not dread the access of air to the wound, so great is his trust in the protection afforded against infection. If morbific germs have been forced into the recesses of the wound, they can not give rise to anything worse than an abscess.

For gargles, mouth-washes, and the like, actol (silver lactate) or itrol (silver citrate) may be used in the proportion of 1 to 4,000 or from that down to 8,000, although stronger solutions do not irritate. These silver salts stain the skin, but the stains are readily removed with a solution of 1 part of corrosive sublimate and 25 parts of sodium chloride in 2,000 parts of water. In surgical infections, actol may be used subcutaneously. In *erysipelas*, the amount to be given daily ranges from 7 to

22 grains, but the solution should not be stronger than one to two hundred, otherwise coagula of albumin will form and stop the remedy from getting into the circulation.

Silver citrate seems to be quite as efficient an *antiseptic* as the lactate, and to be free from some minor disadvantages attributed by Credé to the lactate. The citrate has the trade name of *itrol*. Credé says that it is a perfectly harmless antiseptic and an excellent dusting powder for *wounds*. In the course of four months he has treated many hundreds of wounds with it, and with never the least untoward effect.

Dr. Oscar Werler (*Berliner klinische Wochenschrift*, 1896, No. 37; *New York Medical Journal*, October 3, 1896) states that in the course of about six weeks, in private and public practice, he has used silver citrate in at least fifty cases of acute or chronic *gonorrhœa*, in three of *gonorrhœal urethritis in women*, in *gonorrhœal inflammation of the vulvo-vaginal gland*, and in a few cases of *chronic cystitis*, with very favourable results. It is used as an injection in the ordinary way, also in irrigations according to Diday's method and by a modification of Janet's procedure consisting in washing the entire urethra with a lukewarm solution of the silver salt by means of a large syringe. In acute gonorrhœa he prescribes at the outset a very weak solution, one of 1 to 8,000, and gradually increases the strength. The injections may be used four times a day. The solution should be kept in a yellow bottle. It is important that it should be resorted to without loss of time, before the gonococci have penetrated deep into the mucous membrane. Even in very weak solutions, silver citrate is an energetic antiseptic, disinfectant, and germicide. He sums up as follows: Itrol has an intense gonococcus-destroying action; it is readily borne by the urethral mucous membrane, and causes no noteworthy irritation or increase of the inflammation; its action is deep-reaching, but without injury to the mucous membrane; it therefore meets all the requirements of an efficient remedy for gonorrhœa.]—Matthias Lanckton Foster.

SÍMULO.—This is the fruit of a species of *Capparis* (said by some to be *Capparis coriacea;* by others, *Capparis oleoides*) growing in Peru and Bolivia. It has been recommended as a remedy for *epilepsy*, but experience has shown that it exerts only a palliative effect inferior to that of the bromides, and its employment is now practically restricted to cases in which the use of the bromides is objectionable. The dose is 3 grains, six times a day, in the form of pills. A tincture is prepared, and of that the dose is from 1 to 4 fl. drachms, three times a day.

SINAPIS, SINAPISMS.—See Mustard.

SKULLCAP.—See Scutellaria.

SLAKED LIME.—See under Calx and Lime.

SLIPPERY ELM.—See Ulmus.

SMILACIN, *sarsaparillin*, *salseparin*, *parillin*, or *pariglin*, is a glucoside of the saponin group obtained from *Smilax officinalis*. It crystallizes in fine white needles which are soluble in water and in alcohol. It has been supposed to be the active principle of sarsaparilla, but Kobert has found it inert.

SMILASIN.—This is a gummy substance obtained by precipitating a tincture of *Smilax Sarsaparilla* with water. It must not be confounded with *smilacin*.

SMILAX.—Several species of this genus, particularly *Smilax officinalis*, yield the sarsaparilla of the pharmacopœias.

SNAKEROOT.—See Serpentaria.

SOAP is a chemical compound resulting from the union of fatty acids, such as stearic, palmitic, margaric, and oleic acids, with the alkalies soda, potash, or ammonia. The composition of soaps is analogous to that of the so-called "plasters," in which a fatty acid is united with a basic metallic oxide, such as lime, magnesia, lead, or zinc, but they differ in that, while true soaps are soluble in water, the plasters are insoluble. It was formerly supposed that soap was simply a binary compound of fat and alkali, but all fats and fatty oils are mixtures of glycerides with some fatty acid. Thus, under favourable conditions, glycerin, $C_3H_5(OH)_3$, and palmitic acid, $3(C_{16}H_{31}O_2)H$, become palmitin, $C_3H_5(C_{16}H_{31}O_2)3$, and water $3H_2O$. In the formation of a soda soap the decomposition is as follows:

$$\underset{\text{Palmitin.}}{C_3H_5(C_{16}H_{31}O_2)_3} + \underset{\text{Soda hydrate.}}{3NaOH}$$
$$= \underset{\text{Soap.}}{3NaC_{16}H_{31}O_2} + \underset{\text{Glycerin.}}{C_3H_5(OH)_3}$$

Soaps are characterized by greasiness to the touch, an alkaline reaction, and an acrid taste. They are readily soluble in water, and the solution, when agitated, forms a tenacious froth or "lather." Dissolved in small proportions of hot water, they form homogeneous slimes which on cooling set into jellies or more or less consistent pastes. Among the fatty substances used in the formation of soap are beef, sheep, and horse fat, lard, marrow, and butter, from the animal kingdom, together with palm, olive, castor, and cocoanut oils and cacao butter from the vegetable kingdom.

Drying oils yield softer soaps than non-drying oils, and, of the latter, those that contain a large proportion of olein are softer and more soluble than those richer in stearin or palmitin. But the hardness or softness of the soap depends more especially on the alkali. A soda soap, which is the one commonly used for toilette purposes, however large the proportion of oleic acid, is always "hard," while the potash soap is almost invariably soft, even though made with the more solid fatty acids. They differ also in their behaviour on the addition of common salt to their solutions. When the salt is added in a certain proportion to a solution of soda soap, the soap is at once precipitated, while the same reagent added to a potash soap in solution causes a double decomposition with the formation of a soda soap plus chloride of potassium.

Resin is a common ingredient of many soaps. Its complex acids (chiefly abietic) combine

with the soda or potash, though it is not by a process of true saponification. It occurs more particularly in the so-called "yellow" soaps, which sometimes contain resin in as large a proportion as 40 per cent. or more.

In the manufacture, both of soda and of potash soaps, the fatty matters are first melted and the lye is gradually added to the boiling mixture till it becomes clear, when that mixture is known as "soapsize," and, so far as the potash soap is concerned, this is practically the end of the process. But to make the "curd soap," which is only practicable with soda lye, the fluid mixture which contains an excess of alkali and glycerin is subjected to the "salting-out" process. When salt or brine is added, the soap collects in a granular condition at the top, while the uncombined lye and glycerin gradually sink to the bottom and are drained off. After still further refining, the soap is finally exposed in wooden frames, when it slowly cools and solidifies.

The *Marseilles*, or *Castile*, *soap* is made from olive oil and soda. When the hot solution is allowed to cool and solidify quickly, the impurity and colouring matters are uniformly diffused, and the soap is afterward white or grayish white. But if the process of cooling and solidifying is prolonged, a segregation takes place of the stearate and palmitate, on the one hand, and the oleate, on the other. The latter solidifying more slowly than the others, tends to form into translucent veins into which the greater part of the colouring matter is drawn. In this way is produced the "mottled" or "marbled" soap. Formerly this mottling was esteemed as a guarantee of freedom from excess of water or from adulteration, but, inasmuch as the same effect can be produced by artificially working-in colouring matters while the soap is solidifying, it is no longer necessarily an evidence of purity.

Marine soap is made from soda and cocoanut oil. This oil is peculiar in its behaviour as regards saponification. It does not form emulsions with weak alkalies, as other oils and fats do, even when subjected to long boiling, but with strong alkaline solutions it saponifies very readily, even without heat, and, without the separation of any under-lye, forms a soap of very hard consistence, though containing a large proportion of water. Moreover, it is not insoluble in salt solutions, as curd soaps are, and therefore forms a lather with sea water, with which it can be used for washing purposes.

Transparent soaps are made by dissolving ordinary soap in strong alcohol and distilling off the greater portion of the alcohol till the residue forms a thick, translucent jelly which is afterward poured into moulds and allowed to harden.

The perfuming of soap is effected either by some cheap perfume, which is not affected by alkalies or heat, being stirred into the soap before it has cooled, or, in the fine soaps, by the cold method, which consists in kneading the essential oil into the solid soap, which is first shaved down into thin slices and afterward moulded into cakes by pressure.

Glycerin soap is made by combining a hard soap with glycerin in about equal parts while the soap is in the melted state. If the glycerin is in excess, a fluid soap results which usually has feeble lathering qualities.

Liquid glycerin soaps made from potash, however, yield an abundant, tenacious lather. That made by Sarg, of Vienna, was especially commended by Hebra.

Green soap, *sapo viridis*, *sapo mollis* (U. S. Ph., Br. Ph.), *sapo kalinus* (Gr. Ph.), is "soft" soap and made with potash and fat or a fatty oil. The common commercial variety is made from fish oil. According to the Ger. Ph., linseed oil is used; 100 parts of this are gradually added to 135 parts of a heated solution of potassa. The heat is continued for thirty minutes, then 25 parts of alcohol are added, and as soon as the mixture has become uniform, 200 parts of water are gradually added and the mixture is heated until the mass becomes translucent and will dissolve in hot water without any oil separating. It is then evaporated to 150 parts. A potash-olive-oil soap, used largely in the manufacture of silks, said to be a pure preparation, has been introduced as a medicinal agent by Mr. F. Bagoe, a New York pharmacist.

Green soap, when properly prepared, is of a greenish or brownish-yellow colour, of uniform soft unctuous consistence, free from granulation and rancid odour, and completely soluble in water and in alcohol. It should not contain over 40 per cent. of water, but, as it is hygroscopic, a larger proportion than that is usually present. A tincture of green soap, the *spiritus saponatus kalinus* of Hebra, is much used in medicine; 2 parts of the soap are dissolved in 1 part of alcohol and, after filtering, the solution is perfumed with spirit of lavender. Unna's formula is the following:

Green soap.....	100 parts;
95-per cent. alcohol.....	150 parts;
Oil of lavender.....	½ part.

This tincture forms perfect solutions with chloroform, oil of turpentine, tar, petroleum ether, benzine, and ether, in equal proportions, and with carbon disulphide in the proportion of 5 to 1 at ordinary temperatures or of 5 to 2 at the temperature of the body.

Medicinal Soaps and their Uses.—Both hard and soft soaps are employed medicinally. For internal use, hard, or curd, soap is employed as a menstruum for making pills or as a solvent for resinous medicines whose action it assists somewhat because of its slightly alkaline and antacid effect. Soapsuds are a convenient and valuable antidote to *acid poisons*, when promptly and freely administered, and are also useful as a local application for injuries of the surface by acids or by phosphorus. They are much used too in *laxative enemata*.

But it is in its external applications that soap is chiefly useful in medicine. Its therapeutic uses in the treatment of the skin are manifold. Because of its detergent effect, removing as it does foul secretions and impurities that often harbour parasites and noxious germs, it is most valuable as a prophylactic

against disease. When vigorously applied it has a stimulant effect that is often useful. It shares with alkaline remedies generally the property of modifying and allaying *catarrhal inflammation*, particularly when subacute or chronic, and in still larger degree because in the employment of soap the alkali is carried to the deeper portions of the epidermis. In some forms of *chronic eczema*, besides being *anticatarrhal*, it is decidedly an *anticnesmatic*. This is partly due to the *keratolytic action* of soap. By softening down and removing the horny or scaly covering that conceals the vesicles, it enables the alkali in solution to come directly in contact with the seat of disease. This keratolytic effect is useful in various cutaneous affections associated with excessive accumulation or growths of the corneous layer of the epidermis, such as *ichthyosis*, *lichen planus*, *psoriasis*, and *squamous eczema*. For this purpose the potash or green soap is preferable to the soda soaps. The green soap is often added to ointments for scabies for the same purpose. Further than this, soap has considerable *germicide* power which renders it useful in various parasitic diseases of the skin, such as *ringworm* and *chromophytosis*, or where schizomycetic parasites are present. In the treatment of *chronic eczema*, which is often parasitic, soap frictions are especially valuable. Hebra's method of treating *eczema rubrum* seu *squamosum* of the leg by thorough scrubbing with green soap is still esteemed as one of the very best for this form of disease.

Inveterate psoriasis was treated by Hebra with *green soap* in the following manner: The entire affected surface was smeared with the soap, which was allowed to remain on, and the inunctions were repeated twice a day for from six to eight days, during which time the patient was kept in bed enveloped in woollen blankets. Besides the general applications once a day, a certain section of the diseased skin was treated more energetically, the part being rubbed with the soap hard enough to cause some bleeding, a different section being treated in this way each day till the whole affected surface had been gone over. At the end of this course of treatment, which varied in duration according to the severity of the disease as well as the tolerance of the patient, the skin underwent free desquamation, the epidermis peeling off in lamellar scales, during which time or for three or four days after stopping the inunctions the patient was kept in the same blankets and a bath was not permitted till desquamation was nearly accomplished. When the disease was limited to special areas, these alone were subjected to the soap inunctions without putting the patient to bed, or else the soap was applied as a salve. Diseases due to filamentous parasites as well as some forms of chronic eczema were also treated in this way. For the hairy scalp the tincture of soap is better suited.

As a vehicle for the external application of various remedies soap is coming more and more into use. It is said to be more readily absorbed by the skin than either water or fats by themselves, and for this reason should be a better excipient for drugs administered endermically. Most of the medicinal soaps sold are not sufficiently under medical control, and their composition is for the most part uncertain and unreliable; while, on the other hand, the technical difficulties in the manufacture of soap are such that neither the physician nor the pharmacist, as a rule, is competent to deal with them.

With soft soaps the difficulties are less than with hard soaps. Thus, with ordinary green soap many substances may be combined in an impromptu prescription. Oberlander (*Vierteljahrsch. f. Derm. u. Syph.*, 1882) recommended a *mercurial soap* to be used in place of mercurial ointment for inunctions. It consisted of 3 parts of green soap with 1 part of mercury, combined with a small quantity of glycerin and perfumed with oil of lavender. Unna (*Monatsh. f. prakt. Derm.*, 1886), under the name of *Salbenseife* (*sapo unguinosus*), has described a potash soap made with lard instead of oil, to which 5 per cent. of lard was afterward added in excess, making a superfatted soap. With this he made soaps containing mercury, iodide of potassium, ichthyol, and ichthyol with tar. The mercurial soap differs from Oberlander's chiefly in its excess of fat; 1 part of mercury, having been extinguished with ⅓ part of official mercurial ointment, was incorporated with 2 parts of the superfatted soap. The potassium-iodide soap consisted of 9 parts of the superfatted soap with 1 part of potassium iodide and a little water. Ichthyol (sulphichthyolate of ammonium) was combined with the soap in the ratio of from ½ to 5 parts of the former to 10 of the latter.

Following suggestions of Unna (Ueber medizinische Seifen, Volkmann's *Sammlung klinischer Vorträge*, No. 252), Eichhoff has succeeded in making a large number of *hard soaps* containing many of the remedies commonly used in dermatology, and they are now on the market. The formula for the soap which is the basis of them all is as follows:

Finest beef tallow	59·3	parts;
Olive oil	7·4	"
Soda lye, 38° Beaumé	22·2	"
Potash lye, 38° Beaumé	11·1	"
	100	"

(*Dermatologische Studien*, 2. Reihe, 1. Heft, 1889.)

The following are some of the substances successfully incorporated with this soap: Resorcin (3 to 5 per cent.), salicylic acid (2 to 5 per cent.), salol (5 per cent.), ichthyol (6 per cent., combined usually with 2 per cent. of salicylic acid), menthol (5 per cent.), thymol (0·2 per cent., called children's soap), sulphur (5 per cent., combined with 5 per cent. of camphor and 3 per cent. of balsam of Peru), pineneedle oil (10 per cent.), tar (3 per cent., with 3 per cent. of ichthyol), aristol (2 per cent.), iodoform (5 per cent.), creolin (5 per cent.), and corrosive sublimate (½ to 1 per cent.). These soaps all contain the fatty acids in excess—*i. e.*, are superfatted. In some cases it has been found necessary to acidulate the soap, as in the resorcin soap, to prevent decomposition of

the incorporated drug. For this purpose salicylic acid was first used. It has since been found, however, that a resorcin soap can be made without the salicylic acid, merely by excess of fatty matter. This is effected by adding to the original formula a mixture of 2 parts of lanolin and 3 parts of olive oil in the ratio of 5 per cent. to the whole mass. Indeed, all the soaps are now made with this modification. They lather well, they are agreeable to the skin, and the lanolin is supposed to increase their absorbent effect. They are used (1) by simple washing, as with any ordinary soap, the lather being rinsed off with water, (2) by rubbing the lather well in with flannel cloths till the part is dry, (3) by allowing the lather to dry on gradually, or (4) by retaining it in a moist condition on the surface by means of impermeable dressings.

Buzzi (*Dermatologische Studien*, 2. Reihe, 6. Heft, 1891) takes exception to Eichhoff's plan of making only a superfatted soap, on the ground that thereby the keratolytic action of the soap, which in many diseases of the skin is a desideratum, is largely sacrificed. Moreover, he maintains that the soda used in the hard soap is often apt to cause decomposition of the incorporated medicaments. Thus, in the case of salicylic acid, if it combines with the soda, as it is apt to do, it becomes inert, and though a certain portion may be left free and uncombined in the soap, as soon as water is added the liberated soda would combine with this also. Buzzi, in association with the pharmacist Keysser, of Hanover, has described methods for making three kinds of medicinal soaps—viz., neutral, alkaline, and superfatted—and each of these is made both in the form of a liquid and in that of a soft soap. To obtain the pure fatty acids, a soda soap is first made with olive oil. Then with dilute sulphuric acid this is decomposed, with separation of the fatty acids as a white flocculent sediment. The sediment is washed with distilled water until the filtered liquid is quite neutral. The fatty acids thus obtained are next treated with liquor potassæ, and by the addition alternately of alkali and fatty acid the product is made absolutely neutral. To prevent thickening, a small quantity of pure glycerin is added. This *neutral fluid soap* forms the basis for all the others. From this a "*soft*" *soap* is made by evaporation over the water bath to a salve consistence (*sapo unguinosus*, Keysser). The *alkaline fluid soap* is made by adding 4 per cent. of carbonate of potassium to the fluid neutral soap. With the addition of oil of rose it makes a good toilet soap, useful for *acne* or where *scales* or *crusts* are to be removed. When the carbonate of potassium is added to the thickened soap it forms the *soft, alkaline soap* (*sapo unguinosus cum alkali*). The *superfatted fluid soap* contains from 3 to 4 per cent. of lanolin, and the *superfatted soft soap* 10 per cent. of lanolin (*sapo unguinosus cum lanolino*). These fundamental soaps are combined with a great number of medicaments, a fluid or soft, neutral, alkaline, or superfatted one being chosen as the base according to the special indications. The medicinal ingredients embrace most of those contained in the superfatted soaps of Eichhoff. The corrosive-sublimate soap is made by first dissolving 1 part each of sublimate and oleic acid in 3 parts of alcohol, and mixing this solution with 95 parts of the neutral soap. It is said to be a very stable preparation. A *marble soap* is made by adding 5 parts of marble in very fine powder to 95 parts of the alkaline soap, and is employed as a keratolytic agent.

[White Castile soap is official as *sapo* (U. S. Ph.) and *sapo durus* (Br. Ph.); soft soap, as *sapo mollis* (U. S. Ph., Br. Ph.), and *sapo kalinus* (Ger. Ph.), also, in the crude form, as *sapo kalinus venalis* (Ger. Ph.). The medicinal soap, *sapo medicatus*, of the Ger. Ph. is a soda-lard-olive-oil soap containing 12 parts of alcohol, 25 parts of common salt, and 3 parts of crude sodium carbonate in 540 parts of the soap. The *spiritus saponatus* of the Ger. Ph. is a potash-olive-oil soap used as a stimulating embrocation. A soap, *sapo animalis* (Br. Ph.), made with soda and a purified animal fat consisting principally of stearin enters into the composition of the *emplastrum resinæ*, *emplastrum saponis*, *emplastrum saponis fuscum*, *extractum colocynthidis compositum*, *linimentum potassii iodidi cum sapone*, *pilula phosphori*, *pilula scammonii composita*, *suppositoria acidi carbolici cum sapone*, *suppositoria acidi tannici cum sapone*, and *suppositoria morphinæ cum sapone* of the Br. Ph. The compound pill of soap, *pilula saponis composita* (Br. Ph.), is really an opium pill in which opium is incorporated with four times its weight of powdered hard soap and a sufficiency of glycerin; the dose is from 3 to 5 grains. Soap liniment, or *opodeldoc*, in its various forms, such as *linimentum saponis* (U. S. Ph., Br. Ph.), *spiritus saponato-camphoratus* (Ger. Ph.), and *linimentum saponato-camphoratum* (Ger. Ph.), is a mild stimulating liniment. The liniment of soft soap, or tincture of green soap, *linimentum saponis mollis* (U. S. Ph.), is employed in dermatology for the same purposes as green soap itself. Soap plaster, *emplastrum saponis* (U. S. Ph., Br. Ph.), *emplastrum saponatum* (Ger. Ph.), is employed as a *discutient*. Brown soap plaster, *emplastrum saponis fuscum* (Br. Ph.), is really a cerate.

Soapsuds form an excellent *lubricant* for the fingers in making vaginal and rectal examinations, and scraping the surface of a wet piece of soap with the nail of the examining finger until the space beneath the free border of the nail is filled with soap is a ready means of preventing the lodgment of fæcal matter in that situation in rectal examinations. The use of a soap suppository in the *constipation of infants* is a well-known domestic expedient, harmless and usually efficient.]

EDWARD BENNET BRONSON.

SOAPBARK.—See QUILLAIA.

SOAPWORT.—See SAPONARIA and SAPONINE.

SOCALOIN.—See under ALOIN.

SODA (U. S. Ph.), **SODA CAUSTICA** (Br. Ph.), *caustic soda*, *sodium hydrate*, or *hydroxide*, is little used save for the preparation of

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some of the sodium salts and as a caustic when a moderate and slow action is desired. Its general effect is that of potassa. Combined with equal parts of caustic lime, it constitutes "London paste," a preparation resembling "Vienna paste," but less active, and not giving rise to so much pain.

Liquor sodæ (U. S. Ph., Br. Ph.), *liquor natri caustici* (Ger. Ph.), may be given as an *antacid* in doses of from 2 to 5 minims, well diluted with water.—RUSSELL H. NEVINS.

SODA TARTARATA (Br. Ph.).—See *Potassium and sodium tartrate*, under POTASSIUM TARTRATES.

SODIO-THEOBROMINE SALICYLATE.—This double salicylate of sodium and theobromine was proposed by Gram in 1890 as a means by which the *diuretic* action of theobromine could be obtained without its undesirable effects, and it was introduced as a proprietary medicine under the name of *diuretin*.

Authorities differ in opinion in regard to whether it is a definite compound or simply a mixture of sodium, theobromine, and salicylic acid. According to the *National Dispensatory*, it is "obtained by mixing aqueous solutions of equal molecules of sodium, theobromine, and salicylic acid and evaporating to dryness; a definite compound appears to be formed containing theoretically 49·7 per cent. of theobromine and 38·1 per cent. of salicylic acid. It occurs as a white powder, odourless, of a saline, alkaline taste, and soluble in one half its weight of warm water, the solution remaining perfect on cooling. It should be preserved in well-stoppered bottles, as it is readily affected by the air, theobromine separating by action of carbon dioxide."

The physiological action of sodio-theobromine salicylate is not yet thoroughly understood, and only an approximate idea can be obtained from a collation of the opinions of recent writers on the subject, opinions which do not all agree. When the body is in a healthy condition this drug will produce little or no diuretic effect, but in certain conditions of disease associated with *dropsy* it causes very pronounced diuresis.

From the reports of the experiments of Sabashnikoff and Cohnstein we learn that, when given to the lower animals, this drug certainly does not raise the arterial blood-pressure, but rather tends to lower it, that the respiration is quickened, that large doses at first slow the heart, then make it rapid and finally irregular, and that death occurs from simultaneous arrest of the respiration and the heart in diastole. Both observers believe that it acts as a direct stimulant on the renal epithelium. According to Sabashnikoff, the temperature was invariably raised, unless the administration of the drug was preceded by a high division of the spinal cord, which would indicate that the drug exercises a stimulating influence on the cerebral thermic centres. The same observer noted that the drug acted as a *sialagogue*.

In those diseased conditions in which sodio-theobromine salicylate has an efficient action it is noticeable that it strengthens a weak heart and corrects *arrhythmia*. Clinical observers disagree as to whether this effect is due to a direct action on the heart or not, and quite a large proportion of them consider that it is produced secondarily by the increase of diuresis, the diminution of the œdema, and the consequent removal of obstacles to be overcome by the heart. In view of the results of the experiments on the lower animals just referred to, it is probable that the heart is primarily slightly stimulated by the drug, but that the greater part of the stimulant effect is secondary in its nature.

The effect of sodio-theobromine salicylate upon the arterial blood-pressure is at most very slight. Pawinski considers that it increases the blood-pressure by exciting the vasomotor centres, but other observers do not agree with him, and he is probably mistaken.

Occasionally a rise of temperature is noticed after the administration of this drug, but this is by no means constant, and when it occurs it may possibly be due to nervous irritation.

Upon the gastro-intestinal tract it is apt to act as an irritant, and as such may produce results which vary from simple loss of appetite to severe vomiting and diarrhœa. One writer says that it may increase the appetite.

Upon the kidneys sodio-theobromine salicylate seems to act powerfully, in a non-irritating manner, to increase both the solid and the watery constituents of the urine in the diseases in which it is indicated, but whether its action is upon the excretory epithelium or upon the parenchyma is not yet decided. Probably it is directly on the epithelium. The diuretic effect begins usually within twenty-four hours, and reaches its maximum from the third to the fifth day. The daily quantity of urine excreted increases threefold or fourfold, and sometimes to an excessive degree—ten or twelve quarts of urine passed in twenty-four hours have been reported as resulting from the employment of this drug. Exudations of a non-inflammatory character are then readily absorbed, and the diuresis lessens as the œdema disappears. This diuretic effect certainly can not be obtained if the excretory epithelium is degenerated.

Certain annoying nervous symptoms, such as headache, vertigo, tinnitus aurium, palpitation of the heart, and somnolence or insomnia sometimes result from its use, and in rare instances it causes a cutaneous eruption. No cumulative action has been observed.

The therapeutic power of sodio-theobromine salicylate seems to be almost limited to cases of *dropsical effusion* dependent on disease of the renal or circulatory apparatus. In addition it is useful in some cases of *serous effusion* resulting from inflammation of serous membranes. After digitalis, strophanthus, caffeine, and calomel have failed to reduce *dropsy of cardiac origin*, sodio-theobromine salicylate will frequently succeed. It seems to be of equal efficacy in all forms of valvular disease, aortic as well as mitral, to promote diuresis and absorption of dropsical effusions and to strengthen and regulate the cardiac action.

Here is to be noted the difference between its action and that of such a direct cardiac stimulant as digitalis, which is almost always contraindicated in aortic disease. In cases of dropsy due to *mitral insufficiency* digitalis should be used to promote compensation, and then, if sodio-theobromine salicylate is employed in addition, the removal of the ascitic fluid is accelerated. But it is not only in cardiac weakness due to valvular disease that this drug shows its power. In dropsy dependent on *disease of the heart muscle* itself it seems to be equally efficient. Some observers say it is more efficient in *myocarditis;* others, that its best results are obtained in *valvular heart disease.* Still, though it usually acts so powerfully, it must be admitted that it does not always diminish anasarca of cardiac origin. Whether this may be due to individual idiosyncrasy, or to changes in the renal epithelium, or to something else, has not yet been determined.

In other diseases of the general circulatory system accompanied by ascites, such as *pericarditis, aneurysm,* and *arteriosclerosis,* excellent results are sometimes to be obtained, but the action is uncertain.

In ascites of renal origin the drug is frequently of great benefit. When *interstitial nephritis* has resulted in cardiac trouble and general dropsy this drug is perhaps more efficacious than any other. Regarding its value in *acute nephritis* opinions differ. Some recommend it highly, others advise against its use. It seems to be valuable for the purpose of removing excessive dropsy in the *acute nephritis of scarlatina* after the first acute stage, particularly in childhood. In *chronic nephritis,* unless the epithelium has undergone degenerative changes, it is usually beneficial. In renal troubles due to arteriosclerosis and complicated by heart disease Masius did not obtain any marked diuretic effect with it, but noted that the amount of albumin excreted during twenty-four hours was lessened.

To remove *pleuritic effusions* or other inflammatory local accumulations of serum this drug is at times useful, but is less reliable than in anasarca from circulatory or renal disease.

In cirrhosis of the liver and obstruction of the portal circulation from any cause it is useless for the purpose of reducing the ascites, though it sometimes increases the daily quantity of urine. It is of no value in dropsy dependent on tuberculous inflammation.

A suggestion once made that sodio-theobromine salicylate might avert urethral fever has been negatived by the same writer.

Sodio-theobromine salicylate is not official. The ordinary dose for an adult is from 10 to 20 grains, frequently repeated. From 1 to 3 drachms may be given in twenty-four hours. If diuresis is not increased within six days its use should be stopped and other treatment employed. In cardiac disease it is well to alternate it with cardiac tonics.

Acids and acid vegetable juices are chemically incompatible with it. It should never be prescribed in powders, on account of the change which results from exposure to the air, or in syrups, or in combination with other drugs, because of its great tendency to decomposition. It is best given in plain or aromatic water, but when the disagreeable taste causes serious objection it may be given in pills or capsules. Hypodermic injections of it are said by one writer to be always followed by local abscesses.

When prescribing this drug it is sometimes well to remember that if it is sold under its chemical name of sodio-theobromine salicylate it costs much less than under its proprietary name of diuretin.

[Sir Benjamin Ward Richardson (*Hospital,* March 3, 1894) reports a case of renal dropsy in which sodio-theobromine salicylate failed to keep up free diuresis and induced systemic symptoms like those that are apt to follow the administration of sodium salicylate or salicylic acid, but without the deafness or noises in the head occasionally consequent on the action of those drugs when it is carried to a toxic degree. That the action was not cumulative, he says, was shown by the fact that the symptoms quickly ceased when the use of the drug was discontinued.

The Squibbs (*Ephemeris,* etc., 1895) cite Dr. E. Main's reminder that sodio-theobromine salicylate should not be administered to children less than eighteen months old, because in young infants it is prone to produce digestive disturbances and gastro-intestinal irritation.

Dr. Louis Vintras, of the French Hospital in London (*Lancet,* April 25, 1896), remarks that in considering the value of a therapeutical agent of this kind it is not the ultimate termination of the case which should form the basis of judgment, but its effect on an individual symptom. Sodio-theobromine salicylate, he says, can not be a specific in any disease, and its action can be exerted only for the relief of a distressing complication. Reviewing the results of its use in some cases reported in his article, he says it appears that when the kidney affection is primary and well established—that is, when the deep parts of the organ are affected, as in the parenchymatous form of acute nephritis—and when there is much albumin in the urine, diuretin is of little or no value, while in cases in which the kidney trouble is secondary to morbid lesions in other organs, and the epithelial layer of the urinary tubules is the seat of disease, this diuretic is a valuable therapeutical agent.]—MATTHIAS LANCKTON FOSTER.

SODIUM ACETATE, *sodii acetas* (U. S. Ph.), *natrium aceticum* (Ger. Ph.), is sometimes substituted for potassium acetate as a *diuretic,* but it is less eligible in rheumatic and gouty affections, as its action in increasing the alkalinity of the fluids is much feebler. It may be given in doses of from 20 to 60 grains.—RUSSELL H. NEVINS.

SODIUM AND CAFFEINE SULPHONATE.—See SYMPHOROL.

SODIUM AND MAGNESIUM BOROCITRATE.—This compound has been used to some extent as a remedy for *urinary lithiasis,* in doses of from 5 to 30 grains.

SODIUM AND MAGNESIUM TARTRATE may be used as a *cathartic* in doses of from 2 to 4 drachms.

SODIUM ARSENATE, SODIUM ARSENIATE, *sodii arsenas* (U. S. Ph.), *sodii arsenias* (Br. Ph.), is used in medicine in the form of Pearson's solution (see under ARSENIC, vol. i, page 146).

SODIUM AUROCHLORIDE.—Chloride of gold and sodium (see under GOLD).

SODIUM BENZOATE, *sodii benzoas* (U.S. Ph.), has been employed in *lithæmia* and *rheumatism* for the purpose of freeing the system of uric acid, but it is hardly so efficient as the more commonly employed remedies. As much as 2 drachms may be administered during twenty-four hours, but the size of each single dose should not exceed 15 or 20 grains.

The *borobenzoate* is a somewhat similar preparation. It may be given in doses of from 10 to 15 grains.—RUSSELL H. NEVINS.

SODIUM BIBORATE.—See BORAX.

SODIUM BICARBONATE, *sodii bicarbonas* (U. S. Ph., Br. Ph.), *natrium bicarbonicum* (Ger. Ph.), the "baking soda" of the household, is more freely used to correct *acidity of the stomach* than any other alkaline salt, on account of its non-irritating properties and its relative freedom from disagreeable taste (cf. ALKALIES). It is also useful in the *acid diarrhœa of children;* from 10 to 20 grains, given three times a day, will often decrease the amount of sugar in the urine in *diabetes;* and saturated solutions relieve the pain and irritation of *superficial burns*, and also allay the irritation set up by the *stings of bees, wasps, etc.* When it is taken in drachm doses and followed by an equal bulk of tartaric acid, effervescence takes place in the stomach, and expulsion of its contents rapidly follows. In *intestinal intussusception* the two substances have been injected separately into the large intestine for the purpose of correcting the invagination by the pressure of the gas evolved. The usual dose is from 10 to 20 grains.

[Dr. G. Linossier (*Jour. des praticiens*, April 11, 1896; *New York Medical Journal*, May 2, 1896) says that sodium bicarbonate is serviceable in *deficiency of hydrochloric acid in the gastric juice* only when this affection is not due to a profound alteration in the glands. The essential condition of its action is that the mucous membrane should be still excitable. The amount of the dose also is very important; a very small dose produces an insufficient excitation, and with too large a dose the excitation produced is only enough to neutralize the alkalinity provoked by the ingestion of the medicament. A medium dose should be employed, so that after a slight alkalinity the gastric contents may acquire an acidity greater than that usually present. It is impossible, he says, to give an idea in figures of small, medium, or large doses, for, in reality, the amount can not be absolutely determined; it is relative only to the gastric condition ascertained. He explains the relation between the gastric acidity and the proper dose by saying that the sensitiveness to the action of this drug is in inverse ratio to the richness of the gastric secretion in hydrochloric acid. The doses should be reduced in proportion as the deficiency of the acid becomes more marked. If it is very intense, not more than 8 grains should be given. If the deficiency is moderate, the dose may be increased to 15, 30, or even 45 grains. He thinks, however, that there are some inconveniences in regard to the remote action of the drug if patients suffering with this affection are subjected to the habitual use of large doses, and that it is better to employ doses not exceeding 30 grains.

It is better to give it before meals, so that alkaline saturation may take place before the food enters the stomach, when it comes immediately in contact with the mucous membrane which is in a complete condition of secretory excitation. The larger the dose the longer should the interval be before eating; a quarter of an hour is sufficient for a dose of 8 grains, but an hour is necessary for large doses. It is difficult, says M. Linossier, to lay down absolute rules in this respect, but we may be guided by the subjective symptoms. The ingestion of this drug by dyspeptic patients when fasting is followed by a feeling of satiety analogous to that caused by a very light meal; this sensation gives place subsequently to a feeling of hunger. If the ingestion of food is deferred, and the excited mucous membrane continues to secrete, the patient experiences a sensation of tearing which occasionally produces pain. These symptoms are not always very distinct, but when they are present they are an excellent guide. Sodium bicarbonate should be given at such a time that the hour for the meal shall coincide with the feeling of hunger. The employment of this drug should not be too prolonged; a period of from two to three weeks with intervals of rest is sufficient. This, says M. Linossier, is the surest means of obtaining a remote exciting action, and there is no danger of giving rise to depression.

In cases of *excess of hydrochloric acid*, he says, the alkaline action of the drug may suppress the cause of the pain and uneasiness, which are due to the contact of the mucous membrane with a very acid liquid. It may be doubted, he says, whether the exciting physiological action is not too much for a stomach already greatly excited; this action, however, is not a contra-indication to the use of the drug, provided it is administered in such a way as to prevent any ill effects. For this, it is sufficient to give the sodium in divided doses during the course of digestion, each dose being too small to cause complete saturation of the gastric contents; there is then no violent excitation. The ingestion of each dose, moreover, destroys the effect of the preceding one in saturating the acid which is secreted anew. The doses may vary from 15 to 30 grains, according to the intensity of the excess of acid. The first dose should be given before the probable appearance of the pain; this is easy to determine, as the majority of patients are attacked at an invariable time before eating. The succeeding doses may be given every hour or, if necessary, every half hour until digestion is finished. M. Linossier urges the necessity of prescribing the drug before the appearance of the pain, as it is generally easier to prevent it

than it is to allay it when it has become established.

The tolerance displayed by the organism for this drug is, says the author, remarkable, and the inconveniences of large doses are few as compared to their advantages. The following prescription is often made use of by M. Linossier

℞ Sodium bicarbonate..... 300 grains;
Calcined magnesia..... 75 "
Bismuth subnitrate..... 30 "
M.

This quantity may be divided into twelve or twenty-five capsules, according to the intensity of the acidity, and the proportion of magnesia and that of bismuth subnitrate may be varied in accordance with the intestinal functions.

The remote action of sodium bicarbonate, says M. Linossier, is shown by the excitation and afterward by the depression of the secretion. The period of excitation is very distinct in many patients treated with this drug, and after a few days the original doses, which sufficed to allay the pain, become too weak to saturate the overacidity, and they must be increased gradually. The depression is theoretically the result of an intense and prolonged treatment, and it occurs in patients in whom excessive acidity is not very marked. After a certain time the dose may be diminished by degrees and finally suppressed. In severe acidity, especially if it is accompanied by oversecretion, the sensitiveness to the action of this drug is greatly diminished, and frequently only a palliative effect is obtained.

As regards the use of large doses of sodium bicarbonate, at a recent meeting of the National Society of Medicine of Lyons (*Lyon médical*, June 28, 1896) M. Tournier related the case of a woman who suffered from an excess of hydrochloric acid in the gastric juice. She had been treated with instillations of silver nitrate and with nutritive enemata, but without beneficial results. A course of sodium bicarbonate was then prescribed and begun with amounts of from 180 to 225 grains a day. No relief having been obtained, the quantity was increased to 375 grains, but this amount also proved insufficient, and no real relief was felt until she reached the amount of 750 grains a day. Even this was increased, and without M. Tournier's knowledge the patient took, during a period of a month, from 2 to 2½ oz. a day in doses of 45 grains every fifteen minutes, in milk. During this time, said M. Tournier, there had been no disturbance of any kind and no anæmia, and her weight had increased three kilogrammes. The urine was abundant and presented a feeble alkaline reaction. The intestinal functions were normal.

M. Lépine thought that, in order to tolerate such large doses of sodium bicarbonate, there must be a special receptivity, a pathological condition with exaggerated acidity which should neutralize a part of the sodium. Large doses were incompatible with a normal condition, and it would be dangerous to give them to a healthy person.

In the *Medical Record* for January 18, 1896, Dr. L. Duncan Bulkley gives his experience in the treatment of *coryza* with sodium bicarbonate. He says he has used the drug for this purpose for over two years among his patients, in his family, and among his friends and acquaintances, and is well satisfied of its value.

Recognising that all individuals are not equally "subject to colds," and also that the same individual may exhibit a stronger tendency to them at one time than at another, he had long felt that the susceptibility to this affection depended upon some state or condition of the system, commonly present or occasionally developed. Observation had convinced him also that while it was not persons with a marked gouty diathesis or in an active gouty state that were mainly subject to colds, these latter were more frequently seen in those suffering with minor forms of acidity, and in those in whom it had developed quickly. It therefore occurred to him that the slight relief he had experienced from a cold had been the result of his having taken sodium bicarbonate to neutralize acidity of the stomach.

He thinks it important that the remedy should be taken just right, and a definite plan carried out thoroughly, for he has never seen any effective results from a desultory use of it. For an adult of medium size and weight, from 20 to 30 grains of the bicarbonate are given in 2 or 3 ounces of water, every half hour, for three doses, and a fourth dose is given at the expiration of an hour from the last one. From two to four hours are then allowed to elapse, to see the effect, and the four doses are repeated if it seems to be necessary, as is frequently the case. After from two to four hours more, the same course may be taken again, although this is not often necessary, if the treatment has been begun early in the course of the cold. He has known the doses to be repeated four times, with final good result.

The method is applicable more especially to the early stage of a cold. To be promptly effective, it should be begun with the earliest indications of coryza and sneezing, and his experience has rarely failed to break it up, even in persons much inclined to colds. After the second or third day it acts less promptly, and more frequent repetitions are needed, but he has seen very good results even much later in the trouble.

In *influenza* it is less efficacious, but is often of service. In these cases Dr. Bulkley prescribes from 5 to 10 grains of phenacetine, with from 10 to 20 grains of sodium bicarbonate, and directs the powders to be taken with hot water, every two hours, continuously for a day or two. He has had a large number of very striking instances of the benefit of this plan of treatment; in some cases it was begun several days after the onset of the disease, and in one instance after it had lasted about four weeks. In the latter case the almost immediate relief to many distressing symptoms—headache, cough, malaise, etc.,—was very striking. The patient, a remarkably intelligent gentleman, aged forty-five, had been under varied treatment for the entire

time. In regard to such a frequent repetition of doses of from 20 to 30 grains, he has never seen cause to regret it, and has never known of any later ill effects from it.

Lozenges of sodium bicarbonate, *trochisci sodii bicarbonatis* (U. S. Ph., Br. Ph.), contain each 3 grains (U. S. Ph.) or 5 grains (Br. Ph.) of the bicarbonate. The U. S. troches are slightly aromatic, containing a little nutmeg. From 1 to 10 of the American and from 1 to 6 of the British troches may be given at a dose.]

RUSSELL H. NEVINS.

SODIUM BISULPHITE. — See under SULPHUROUS ACID.

SODIUM BORATE.—See BORAX.

SODIUM BROMIDE.—See under BROMIDES.

SODIUM CANTHARIDATE has been used to some extent in the same way as potassium cantharidate in the treatment of *pulmonary tuberculosis* (see under CANTHARIDES and CANTHARIDIC ACID).

SODIUM CARBOLATE has been recommended as an *intestinal antiseptic* in *diarrhœa*, *dysentery*, and *typhoid fever*, given in doses of from 2 to 10 grains. The sulphocarbolate has been more employed in these affections. Sodium carbolate has been used also as an external antiseptic (see *Phénol sodique*, under PHENOL).

SODIUM CARBONATE, *sodii carbonas* (U. S. Ph., Br. Ph.), *natrium carbonicum* (Ger. Ph.), sal soda or washing soda of commerce, *natrium carbonicum crudum* (Ger. Ph.), is not much employed internally in medicine, as the bicarbonate possesses all of its useful properties and is less irritating and of a more agreeable taste. Externally, it is used in nearly all conditions in which it is desirable to soften or remove *scaly* or *scabby accumulations upon the skin*, as in certain forms of *eczema*, *plica polonica*, etc. It may be given in 10-grain doses, but in overdoses is corrosive.

Mild sodium carbonate, *sodii carbonas exsiccatus* (U. S. Ph.), *sodii carbonas exsiccata* (Br. Ph.), *natrium carbonicum siccum* (Ger. Ph.), is sodium carbonate deprived of its water of crystallization. It does not differ in its properties from the crystallized form, and is given in 5-grain doses, usually in the pill form.

RUSSELL H. NEVINS.

SODIUM CETRARATE, a salt of cetraric acid, soluble in water, is said to act as a *tonic* when given in doses of from 2 to 15 grains, but the clinical reports on its employment are at present not such as to warrant positive statements with regard to it.

SODIUM CHLORATE, *sodii chloras* (U. S. Ph.), has essentially the same properties and uses as the corresponding potassium salt, and may be substituted for it in doses of from 5 to 15 grains.

[In the palliative treatment of *cancer of the uterus* Boucher, of Rouen, according to the *Therapeutische Wochenschrift* for August 16, 1896, prescribes the following:

℞ Sodium chlorate..... 2 parts;
Distilled water..... 10 "
Syrup of orange flowers..... 3 "
M. At first two "spoonfuls" (whether teaspoonfuls or tablespoonfuls is not stated) are to be taken in twenty-four hours, and the daily amount is to be increased gradually to eight "spoonfuls."

The following powder is applied on intracervical tampons:

℞ Sodium chlorate, Bismuth subnitrate, } of each... 2 parts;
Iodoform..... 1 part.
M.

In addition, the vagina is irrigated daily with a solution of 150 grains of sodium chlorate in a quart of boiled water. It is said that this treatment often prolongs life for a year and makes it reasonably tolerable.]

RUSSELL H. NEVINS.

SODIUM CHLORIDE, *sodii chloridum* (U. S. Ph., Br. Ph.), *natrium chloratum* (Ger. Ph.), or common salt, while it does not play a very important part in medicine, may be of considerable value as a substitute for more active remedies. A tablespoonful, dissolved in a tumblerful of cold water and swallowed before breakfast, will usually act as a *cathartic*, and double that amount, in a similar bulk of warm water, is one of the most readily obtained and prompt *emetics* and one that is rarely followed by depression. A teaspoonful, taken dry, is a useful *hæmostatic* in *epistaxis* and other *capillary hæmorrhages*. In *intermittent fever*, 2-drachm doses, given every two hours during the intermissions, is said to be useful, especially when combined with lemon-juice or lime-juice. Added to water in the proportion of ¼ of a pound to the gallon, salt forms a solution of approximately the same specific gravity as sea water, and may be used for general or local baths, being particularly useful for a foot-bath after prolonged exercise. A number of preparations termed "sea salt" are on the market, which purport to be the residue left upon evaporating sea water, and to be of greater value for preparing baths, etc., than the purer articles, but it is probable that there is no special virtue in them. A teaspoonful of salt, dissolved in a pint of water, may be used as a gargle in *nasal catarrh* and *pharyngitis*. It is also sometimes added to enemata to increase their irritant effect.

[The value of sodium chloride in the form of the so-called "physiological salt solution" will be found set forth in the section on *Infusion* of the article on TRANSFUSION.

Mr. F. J. Reilly, M. R. C. S. (*British Medical Journal*, November 23, 1895), says that for several years he has used common salt as a remedy for *ringworm*. Children, he says, who are suffering from *tinea tonsurans* are sent to the seaside and almost invariably improve in the salt air. This improvement has hitherto been ascribed to the general favouring influence of the open-air life and improved hygienic conditions under which children live at the seaside. But, he asks, when we remember the fact that the air near the sea is impregnated with minute par-

ticles of sea water containing in solution as it does a large proportion of sodium chloride, may we not reasonably ascribe the disappearance of the skin disease to this circumstance? This fact, he says, arrested his attention and led him to think that common salt might prove a valuable remedy in ringworm. Accordingly, he prepared a solution and used it in the next three cases which he was called upon to treat, applying it to the diseased scalp every night for five nights and washing it off on the following morning with 10-per-cent. boric-acid soap. In less than four weeks a cure was effected in each case. Mr. Reilly does not mention the strength of the solution employed by him, but presumably it was a strong one.]—RUSSELL H. NEVINS.

SODIUM CHOLEATE.—Under this name a purified preparation of ox-gall is furnished by Merck. It is described as a yellowish-white powder, to be given in doses of from 5 to 10 grains. (See OX-GALL.)

SODIUM CITRATE resembles the other alkaline citrates in being *laxative*, *diuretic*, and *refrigerant*. Not usually being met with in the shops, it is prepared extemporaneously by adding sodium bicarbonate to lemon-juice or a solution of citric acid. This combination effervesces quickly and quite actively, and, unless a sufficiently large vessel is employed, is apt to foam over. From 5 to 10 drachms of soda neutralized with citric acid will constitute a *cathartic* dose of this preparation.

RUSSELL H. NEVINS.

SODIUM CITRO-TARTRATE.—Effervescent citro-tartrate of sodium, *sodii citro-tartras effervescens* (Br. Ph.), is a granulated mixture of 17 parts of sodium bicarbonate, 9 of tartaric acid, 6 of citric acid, and 5 of sugar. It has the same *laxative*, *diuretic*, and *refrigerant* properties as sodium citrate. The dose is from 1 to 2 drachms, dissolved in water and taken while it is foaming.

SODIUM DIIODOPARAPHENOLSULPHONATE.—See SODIUM SOZOIODOLATE.

SODIUM DIIODOSALICYLATE.—See under DIIODOSALICYLIC ACID.

SODIUM DITHIOSALICYLATE.—See under DITHIOSALICYLIC ACID.

SODIUM ETHYLATE, or *caustic alcohol*, is a preparation sometimes used as a *caustic*, its alcoholic or aqueous solution being applied with a glass rod to the parts to be affected. Its action is reputed to be painless and of special value for the destruction of *warts*, *nævi*, *small condylomata*, and similar growths. Solutions of the strength of 20 per cent., especially those made with olive oil, are often useful for inunction in *psoriasis*.

Liquor sodii ethylatis (Br. Ph.) is a 20-per-cent. alcoholic solution of this salt.

RUSSELL H. NEVINS.

SODIUM ETHYLSULPHATE.—See SODIUM SULPHOVINATE.

SODIUM FLUORIDE.—See FLUORIDE.

SODIUM FLUOSILICATE.—See SODIUM SILICOFLUORIDE.

SODIUM FORMATE, $NaCHO_2 + H_2O$, occurs in white deliquescent crystals that are soluble in water and in glycerin. Its subcutaneous employment, in quantities of from ½ to 1 grain, at intervals of from a week to ten days, has been reported to be of benefit in the treatment of *tuberculous diseases*.

SODIUM GLYCERINOBORATE.—This glycerite of borax, prepared by Merck from 40 parts of borax and 60 of glycerin, with the aid of heat, is described as a translucent, brittle, and very hygroscopic mass soluble in water. Its uses are the same as those of the *glyceritum boroglycerini* (see under BORIC ACID, vol. i, page 191).

SODIUM HYPOPHOSPHITE.—See under HYPOPHOSPHITES (vol. i, page 519).

SODIUM HYPOSULPHITE.—See under HYPOSULPHITES (vol. i, page 519).

SODIUM IODIDE, *sodii iodidum* (U. S. Ph., Br. Ph.), *natrium jodatum* (Ger. Ph.), is employed for the same purposes as potassium iodide. It may be given in doses of from 5 to 60 grains.

SODIUM LACTATE, $NaC_3H_5O_3$, is a thick, syrupy liquid. It may be given as a *hypnotic* in cases of *insomnia*, in doses of from 2 to 4 drachms. (See LACTIC ACID.)

SODIUM NITRATE, *sodii nitras* (U. S. Ph., Br. Ph.), *natrium nitricum* (Ger. Ph.), or cubic nitre, has properties somewhat similar to those of the corresponding potassium salt. It is oftener employed in veterinary medicine as a *diuretic* than in the treatment of the human subject, although it has been recommended in *dysentery*, in drachm doses, freely diluted, every three hours.

SODIUM NITRITE.—See under NITRITES (vol. ii, page 13).

SODIUM PARACRESOTATE, $C_8H_7NaO_3$, according to Merck, is a fine microcrystalline powder, of a bitter taste, soluble in 24 parts of warm water. It is said to be *antipyretic*, *antiseptic*, and *analgetic*. Dr. Cerna says that it has been used with success in the treatment of *rheumatism*, *catarrhal pneumonia*, *typhoid fever*, and *gastro-intestinal disorders* in general, and is well borne by the stomach. He adds that it is said to be particularly suitable for children. The dose is from 1 to 20 grains.

SODIUM PHENOLSULPHONATE.—Sodium sulphocarbolate (see under SULPHOCARBOLATES).

SODIUM PHOSPHATE, *sodii phosphas* (U. S. Ph., Br. Ph.), *natrium phosphoricum* (Ger. Ph.), is hardly suitable for producing the constitutional effects of either its base or its acid, and is almost exclusively used as a *laxative* and *cholagogue*, the latter action being pretty clearly established. It is freely soluble and of a not unpleasant taste, and is particularly adapted for children, to whom it may be given dissolved in milk. Also tolerance of it is not established speedily, and it may be

given for months without any ill effects following. For children who pass pasty and pale-coloured stools, exhibiting at the same time the symptoms of *malnutrition*, there is probably nothing so useful as 10-grain doses of sodium phosphate three times daily. Ordinary *sick headache* may also be greatly alleviated by doses of from 20 to 30 grains three times a day, after eating, taken for a week or so, and the course repeated after an intermission of the same length of time, due attention being paid to the diet. An attack may also be aborted by two or three full doses, from 1 to 2 oz., taken as soon as the premonitory symptoms are noticed. In *gastro-duodenal catarrh* and the *jaundice* dependent upon it, it usually works well, and it is very useful in the *epidemic jaundice of warm climates* not dependent upon organic disease of the liver. The tendency to the formation of *biliary calculi* is also somewhat lessened under its persistent administration, but after their formation it is doubtful if it is of benefit. In *sclerosis of the liver* it is worthy of a fair trial, for, if it has no curative effect, it renders the condition of the patient much more tolerable. In the obese and diabetic in whom there may be a troublesome succession of *boils* or *carbuncles* it often effects a cure, and the same may be said of those cases in which no clearly defined dyscrasia exists. In *lithæmia* it is usually of value in preventing to a great extent the occurrence of the *headache* which appears to depend upon faulty intestinal digestion or upon fermentation of the contents of the intestines. It is not maintained that there is anything actually specific in the action of this salt, but that whatever benefits follow its employment are due to its property of restoring to its normal condition the upper portion of the intestinal canal and stimulating the flow of the bile.

As a laxative, from 1 to 2 oz. may be given, but when the use of the salt is to be protracted not over a drachm, three times a day, is advisable. For children 10 grains will usually be a sufficient dose. The effervescent phosphate of sodium, *sodii phosphas effervescens*, of the Br. Ph. (additions) contains, besides the phosphate, small amounts of sodium citrate and tartrate, and is consequently slightly *diuretic*. It may be given in doses of ½ oz. dissolved in a tumblerful of water.

[The *Province médicale* for October 17, 1896, contains an abstract of an article from the *Journal de médecine de Paris* for September 27, 1896, in which the writer remarks that a 0·1-per-cent. solution of sodium phosphate in sterilized water is proper to employ in subcutaneous injections. After the usual antiseptic precautions are taken, the injections are practised in the retrotrochanteric groove. These injections have been employed in *tabes dorsalis*, *hemiplegia*, *neurasthenia*, and *progressive myopathic paralysis*. In locomotor ataxia the darting pains and the troubles of motility are considerably diminished. Also in other affections marked amelioration is produced. Sometimes this salt has a direct action on the nervous system; the organism seems to experience a functional overactivity, and it produces symptoms of intolerance. On the whole, says the writer, it may be said: 1. That sodium phosphate exerts an action on the organism which is due to the exciting influence which it produces on the central nervous system. 2. That if the injections are carefully administered hypodermically, the solution does not give rise to any local reaction. 3. That the therapeutic value in locomotor ataxia, in neurasthenia, in hemiplegia, and in progressive myopathic paralysis is worthy of consideration. 4. That the hypodermic injections should be carefully watched in order to prevent the appearance of the symptoms of intolerance which are often produced.]

(Cf. *Sodium phosphate*, under PHOSPHORUS, vol. ii, page 79.)—RUSSELL H. NEVINS.

SODIUM PYROPHOSPHATE.—See under PHOSPHORUS (vol. ii, page 79).

SODIUM SACCHARINATE.—See under SACCHARIN.

SODIUM SALICYLATE.—See under SALICYLIC ACID.

SODIUM SANTONINATE.—See under SANTONICA.

SODIUM SILICATE.—See under SILICATES.

SODIUM SILICOFLUORIDE.—This compound has been recommended for use like fluorol (*q. v.*). Sufficiently definite reports of its action are not yet at hand to warrant its recommendation here.

SODIUM SOZOIODOLATE, $NaOC_6H_2I_2OHSO_3+2H_2O$, is furnished by Merck in the form of colourless acicular crystals soluble in 14 parts of water. It is said to be *antiseptic* and *antipyretic*. The powder, blown into the nose to the amount of 3 grains daily, has been reported to be efficacious in the treatment of *whooping-cough*. Dr. Cerna remarks that it is considered superior to iodoform as an application to *syphilitic ulcers*, and serviceable in *nasal catarrh*. Internally, as an *intestinal antiseptic*, it may be given in daily amounts of from 5 to 30 grains. Its internal administration is said to have proved serviceable in *diabetes*.

SODIUM SULPHATE, *sodii sulphas* (U. S. Ph., Br. Ph.), *natrium sulfuricum* (Ger. Ph.), Glauber's salt, is used to some extent as a *laxative* in doses of from 2 drachms to 1 oz., dissolved in water, in cases of *constipation* and *sluggishness of the liver*. The dried sulphate, *natrium sulfuricum siccum* (Ger. Ph.), is considered preferable to the crystalline salt as an ingredient of powders compounded in imitation of the salts of natural mineral waters.

SODIUM SULPHITE.—See under SULPHUROUS ACID.

SODIUM SULPHOBENZOATE, *sodii sulphobenzoas*, has been recommended as an *antiseptic*. It may be employed in a 1-per-cent. aqueous solution.—RUSSELL H. NEVINS.

SODIUM SULPHOCARBOLATE.—See under SULPHOCARBOLATES.

SODIUM SULPHOLEATE.—Dr. George H. Fox (*Journal of Cutaneous and Genito-urinary Diseases*, May, 1890) remarks that when sulphuric acid is added slowly to any fixed oil or fat at a low temperature, the oleic acid is transformed into sulpholeic, or sulpholeinic, acid. A soda soap made with a fat so treated—sodium sulpholeate or, if castor oil is used, sodium sulphoricinoleate—is a mass resembling vaseline in appearance and consistence, and Dr. Fox has found it an excellent *base for ointments* for the reasons that it mixes readily with water, that it is absorbed rapidly by the skin, and that it dissolves a great number of medicinal substances used topically in the treatment of *skin diseases*.

SODIUM SULPHOMETHYLATE is *cathartic* in ½-oz. doses, but has not met with any great favour.—RUSSELL H. NEVINS.

SODIUM SULPHORICINATE, SODIUM SULPHORICINOLEATE.—See under SODIUM SULPHOLEATE.

SODIUM SULPHOVINATE, or *ethyl sulphate*, is an unstable and rather expensive salt with an agreeable taste. In doses of from 4 to 5 drachms it produces free catharsis without any pain, and when it can be procured fresh and expense is no object, it is very desirable for use in children.—RUSSELL H. NEVINS.

SODIUM TARTRATE.—This salt is *purgative* and *diuretic* in doses of from ½ to 1 oz. It is free from the bitter taste of some of the other saline cathartics. For potassium and sodium tartrate (Rochelle salt), see under POTASSIUM TARTRATES.

The effervescent citrotartrate of sodium, *sodii citrotartras effervescens* (Br. Ph.), is a granular effervescent salt which is mildly *laxative* and *refrigerant*, and may be employed in the *febriculæ* and to relieve *nausea*. It may be given in doses of from 1 to 2 drachms dissolved in water and drank while effervescing.
RUSSELL H. NEVINS.

SODIUM TAUROCHOLATE.—See SODIUM CHOLEATE.

SODIUM TELLURATE has been used to some extent as an *anthidrotic* in the *night-sweats* of phthisis and other exhausting diseases. It is soluble in water. The dose is from ¼ to ⅔ of a grain.

SODIUM TETRABORATE.—According to Professor Coblentz, this compound consists of equal parts of boric acid and sodium biborate. It dissolves readily in water and is used as an *antiseptic*, usually in a 16-per-cent. solution.

SODIUM THIOPHENE - SULPHONATE is described by Professor Coblentz as a white crystalline powder of an unpleasant odour, soluble in water, and containing 33 per cent. of sulphur. In the form of an ointment of from 5 to 10 per cent., also in that of a dusting-powder, it has been used in the treatment of *prurigo* and some other skin diseases.

SODIUM THIOSULPHATE, *natrium thiosulfuricum* (Ger. Ph.), is the same as sodium hyposulphite. (See under HYPOSULPHITES, vol. i, page 519.)

SODIUM TUMENOL SULPHONATE.—See under TUMENOL.

SODIUM VALERIANATE.—The virtues of this salt are those of valerian. (See VALERIAN and VALERIANIC ACID.)

SOJA HISPIDA, or *Glycine hispida*, or *Glycine Soja*, is a Japanese leguminous plant from the seeds, or beans, of which a sauce known as *soy* is prepared. The plant has been acclimatized in India, China, and Austria. In France there are to be had bread, cakes, and biscuits made from the beans, which have been recommended as articles of food for persons affected with *diabetes*, on account of their comparative freedom from starch.

SOLANIN.—This principle, which should not be confounded with the alkaloid *solanine*, is found in various species of *Solanum*. According to Professor Coblentz, its formula is $C_{42}H_{87}NO_{18}$. It is a bitter, crystalline substance insoluble in water. It has been used to some extent as an *analgetic* in cases of *neuralgia*, in doses of from ⅛ to 1 grain.

SOLANINE.—See under DULCAMARA.

SOLANUM CAROLINENSE.—This is the American horse-nettle, or bull-nettle, a weed that grows abundantly in the Atlantic States. The juice of the berries, *succus solani*, and a fluid extract prepared from them have been used as a remedy in various convulsive affections, such as *chorea*, *puerperal eclampsia*, and especially *epilepsy*. It has even been employed in *tetanus*. According to Dr. Charles S. Potts, of the University of Pennsylvania (*Therapeutic Gazette*, December, 1895), and Dr. C. F. Barber (*Journal of the American Medical Association*, December 14, 1895), the first published report of the use of this drug in epilepsy was made by Dr. J. L. Napier, of Blenheim, South Carolina, in the *Medical World* in 1889. Dr. Napier had obtained his knowledge of it from the negroes, who used it as a domestic remedy for convulsions.

Dr. E. B. Bondurant, of the Alabama Insane Hospital at Tuscaloosa (*Medical News*, March 30, 1895), reports eleven cases among the inmates of the institution, in none of which was any favourable effect produced. He adds, however, that insane epileptics doubtless have the disease in its most unfavourable form. He used Parke, Davis, & Co.'s fluid extract, in doses of from ½ to 1 fl. drachm, three times a day. On the other hand, a writer in the *Medical Reporter*, of Calcutta, for July 1, 1895, says that he has used the same fluid extract in doses of from 10 to 15 drops, three times a day, after meals, and feels encouraged as to its therapeutic powers, although the number of cases in which he has prescribed it is not large enough to warrant him in positive statements. He cites an article published in the *Indiana Medical Journal* for November, 1894, by Dr. Allison Maxwell, of Indianapolis, who concludes, from his own use of the drug and from that of several other observers, that it "materially controls epileptic seizures and is worthy of considerable confidence."

Dr. Potts (*loc. cit.*) gives the histories of

seventeen cases and gives his conclusions as follows:

"1. That the drug has a decided influence for good upon the epileptic paroxysm. 2. That this influence is probably not so great or so sure as that obtained by the use of antipyrine and the bromide salts, or even of the mixed bromides. 3. That in those cases in which it is of service it relieves the paroxysms without causing other unpleasant symptoms, such as are sometimes caused by the use of large doses of the bromides. 4. That the dose ordinarily recommended (10 to 15 drops of the fluid extract) is too small, and that as much as a teaspoonful or more four times daily is often needed to secure results."

Dr. Barber (*loc. cit.*) has of late employed the fluid extract in doses of from ½ a fl. drachm to ½ a fl. oz. The ages of the patients ranged from eight to fifty years, and the cases comprised those of epilepsy with idiocy, epilepsy with insanity, epilepsy with *grand mal* and *petit mal*, and epilepsy from traumatism. Among them were those of five girls and three boys. The girls, who had been having epileptic attacks every day, did well for three weeks, having no convulsions, but at the end of that time the convulsions returned and the patients relapsed into their former condition. The dose was pushed, but no improvement was noted, and the treatment was abandoned. The boys had a mild outbreak of convulsions followed by an interval of rest for about a week, when they gradually relapsed into their former epileptic state. Among the epileptics who were the subjects of *grand mal* Dr. Barber had about the same results as with the male epileptic idiots, save that the period of improvement continued longer and the relapse was more gradual. Ten who were under the influence of the drug did not have a convulsion for twenty-nine days. Then a patient who was in the habit of having from three to six seizures a week had an attack so mild that he was not obliged to lie down. This patient was mentally much brighter than he had been for some time before, and was capable of doing light work about the ward. He still had his epileptic attacks, but they were milder in form than previously.

Dr. Barber does not regard solanum as an efficient substitute for the bromides, but he thinks it preferable to borax. He says it unquestionably has an influence over the disease, but only a mild one; it controls it sufficiently to warrant its use for a time to relieve the patients of the depression due to the bromide treatment.

Dr. E. Q. Thornton, demonstrator of therapeutics in the Jefferson Medical College (*Therapeutic Gazette*, November, 1896), has experimented with a soft extract made by Parke, Davis, & Co. He was unable to detect any effect on dogs, rabbits, guinea-pigs, or pigeons, but he says that when the soft extract is injected hypodermically into the posterior lymph space of the frog in doses of about 3 milligrammes to the gramme weight of the batrachian, respiration becomes gradually slower and laboured, then gradually returns to the normal in about three hours as the effect of the drug passes off. If the drug is given in toxic doses the respiration becomes slow, shallow, and irregular, and death results from respiratory failure. Dr. Thornton was somewhat surprised to find that *Solanum carolinense*, a plant belonging to the same natural order as belladonna and hyoscyamus, had no effect upon the circulation.

The effect upon the nervous system he found most marked, depressing the cerebrum and powerfully stimulating the spinal cord. After receiving an injection of the drug into the posterior lymph space, the frog, he says, becomes quiet and apparently stupefied, and retains the normal posture, but if irritated it will make very long leaps, alighting usually upon its belly, although frequently upon its back, with its fore and hind legs extended in tetanic spasms, the hind limbs being more decidedly affected than the fore limbs. The limbs are thrown into spastic extension each time the animal hops or attempts to hop, and these spasms last about from ten to thirty seconds. Sharp jars, a sharp tap, and pin-pricks bring on the spasms, although they are not then nearly so marked as when the animal leaps or attempts to leap. Division of the spinal cord does not prevent the spasms. The frog recovers from the condition of spasm in from three to five hours if the dose has not been so large as to be lethal. Lethal doses are preceded by the condition above related, but finally depression or exhaustion takes the place of excitement or stimulation, and the animal lies limp, failing to respond to any stimulus.

In the experiments the respiration became laboured and slower after the drug had been administered, and when large doses were given the breathing ceased before the heart stopped.

SOLANUM DULCAMARA.—See DULCAMARA.

SOLANUM PANICULATUM. — The root of this Brazilian shrub is used by the physicians of Brazil as a *purgative* and *deobstruent* in *diseases of the liver* and *of the spleen*, also as a *tonic* and as a remedy for *catarrh of the bladder*. Elsewhere than in South America it has not yet passed the experimental stage of medicinal employment. Kobert has found it inert, but Michaelis, who has given 16 drops of a fluid extract three times a day, thinks it is undoubtedly *stomachic* and useful in *biliary colic* and in *chronic dyspepsia*. (*Medicinisch-chirurgisches Central-Blatt*, April 24, 1896; *New York Medical Journal*, May 16, 1896.)

SOLIDAGO.—*Solidago odora* (or *odorata*), the sweet-scented golden-rod of the United States and Canada, was formerly official. The leaves are *aromatic* and *carminative* and, when given in a hot infusion, *diaphoretic*.

The common golden-rod, *Solidago virga aurea*, *Solidago vulgaris*, also was formerly used in medicine. It has lately (*Therapeutische Wochenschrift*, May 10, 1896) been recommended anew in the form of Rademacher's tincture, in doses of 30 drops several times a day, as a *diuretic*. The writer gives the following formula:

℞ Fresh infusion of digitalis..... 150 parts;
Rademacher's tincture of solidago. 20 "
Syrup of orange peel..... 30 "
M. S.: A teaspoonful to be taken every two hours.

SOLPHINOL. — Professor Coblentz describes this as an *antiseptic* mixture of borax, boric acid, and alkaline sulphites. According to Dr. Cerna, it is soluble in 10 parts of water and in 20 of glycerin, and is said to be an efficient antiseptic in the treatment of *wounds*, in a solution of from 2 to 10 per cent. It must not be confounded with *sulphonal*.

SOLUTOL.—This is an alkaline solution of sodium cresylate in an excess of cresol, containing 15 per cent. of free cresols. It is an *antiseptic* used chiefly for preserving corpses and disinfecting bedclothes, excreta, privies, etc.

SOLVENTS.—A solvent, as understood in pharmacy or chemistry, is a substance, usually a liquid, which is capable of dissolving another substance (gas, liquid, or solid) without altering the nature of the latter. While nitric acid, for instance, will dissolve copper, or acetic acid chalk, neither of these liquids is a true solvent of the respective substance, since the latter no longer exists as such in the solution.

The principal solvents employed are either non-volatile or volatilized with difficulty, such as glycerin, paraffin oil, solution of soda or potassa, limewater, etc.; or else more or less volatile, such as water, methyl alcohol (or wood-spirit), ethyl alcohol (ordinary alcohol), amyl alcohol (fusel oil), acetone, acetic acid (glacial or of other strength), ether, acetic ether, chloroform, carbon disulphide, petroleum ether (benzin), benzol (from coal-tar), solution of ammonia, etc.

Only a few of these solvents are suitable for retaining medicinal substances in solution when it is desired to administer the latter in a liquid form. Water is, of course, under all circumstances the most harmless and preferable, but it fails to dissolve or to keep in solution many bodies, such as resins, oils, balsams, and various other proximate principles. In these cases a menstruum or solvent must be selected which will approach the aqueous state as far as practicable. That is to say, if it is found that a certain substance is readily soluble —for instance, in a mixture of 1 part of alcohol and 2 parts of water—the alcoholic percentage should not be increased unless, perhaps, for preservative reasons, because the physician does not wish to complicate the medicinal action of the drug with the special effects of the menstruum itself. In some cases the employment of a pure volatile, non-aqueous menstruum is unavoidable. Then it becomes necessary to combine or to disguise the solution in such a manner that the secondary effects of the solvent are obtunded. For instance, a solution of phosphorus in absolute alcohol is very disagreeable to take. If, however, it is suitably combined with aromatic elixir, its harshness and disagreeable taste are entirely removed.

The solvents mostly used for pharmaceutical preparations from crude vegetable drugs are water and alcohol, either separately or in combination, often with the addition of glycerin, and sometimes of water of ammonia or of acetic acid. The latter two are solvents in so far as they combine with certain insoluble active principles and convert them into soluble compounds, from which the free principles themselves can at any time be again separated in their original state by neutralizing the alkali or the acid, as the case may be.

After a drug has been exhausted by a volatile solvent it is often desirable to concentrate the solution. If the solvent is valuable, and a gentle heat can not injure the preparation, the latter is subjected to distillation at as low a temperature as possible, so that the volatile solvent may be recovered as far as practicable.

Some of the solvents mentioned above have so little affinity for each other that, when they are mixed by agitation, they will speedily separate again, and in most cases will not retain more than traces of each other in solution. This fact enables the chemist to transfer a substance from one solvent to another. It is particularly made use of for the separation of alkaloids, certain organic acids, and some other proximate principles. For instance, if some tincture of nux vomica is mixed with enough dilute ammonia water to set free all the alkaloids (though the latter may still remain in solution) and the mixture is then shaken with chloroform, the latter will take up part of the alcohol present and all of the alkaloids, together with some colouring matter. On now shaking this chloroform, after separating it, with pure water, the latter will abstract the alcohol and nearly all the colouring matter. The chloroform will still retain the alkaloids. If it is now shaken with some dilute aqueous acid, the latter will search out the alkaloid, combine with it, and transfer the alkaloidal salt, which is not soluble in chloroform, to the aqueous layer. From this the alkaloid may again be extracted, after the addition of an alkali, by chloroform, ether, or any other volatile menstruum capable of dissolving it, and not miscible with water. This method of extraction is known as the process of "extraction by immiscible solvents."

Water, either cold or hot, is the solvent most generally employed, and, when it alone suffices, is always to be preferred for medicinal compounds. It is to be regretted that the method of administering many vegetable drugs by infusion or decoction has almost gone out of use. In many cases it might have been retained with advantage. Infusion of digitalis has survived because it is well known to possess properties which are not inherent in any preparation of digitalis made with the intervention of alcohol.

Alcohol is the solvent next in importance. There are many important constituents of drugs which are insoluble in water, and require another solvent, such as alcohol, ether, chloroform, etc. But of all these volatile solvents none is so free from objectionable features as alcohol. Wherever there are essential oils, resins, alkaloids, or certain glucosides to be ex-

tracted and kept in solution, alcohol usually forms at least a part of the menstruum. It does not dissolve gums, albumin, starch, lignin, etc., most of which substances are inert medicinally. Alcohol is also often added to preparations, not so much for its solvent as for its preservative powers.

The attempt has at various times been made to banish alcohol altogether from medicinal or pharmaceutical preparations, in compliance with the demand of ignorant fanatics, who are unable to discriminate between the usefulness and uselessness of some product of nature, and who, therefore, have erroneous ideas regarding its use or abuse. Up to the present time no liquid has been found, which is not itself more or less of the nature of alcohol, which would be able to take its place as a solvent. It is not impossible that such a liquid or combination of liquids may in the future be discovered. An important step in this direction has been made by Dr. Edward R. Squibb, of Brooklyn, who has succeeded in extracting drugs, previously held to be assailable by alcohol only, by means of acetic acid. It will require extended experiments, however, to ascertain whether this process will furnish preparations in every respect suitable as medicines.

Glycerin is an important solvent as well as preservative. Owing to its viscid nature, it is not often used alone as a solvent, but usually in combination with alcohol or water, or both. It dissolves many inorganic compounds, nearly all substances soluble in water, and many soluble in alcohol.

Ether is more restricted in its solvent power. It dissolves nearly all oils, most resins, and many alkaloids and neutral principles. In combination with alcohol, it dissolves gun-cotton, the resulting product being collodion. As it possesses valuable therapeutic properties of its own, it is used as a partial solvent in such preparations as ethereal tincture of lobelia, ethereal tincture of acetate of iron, etc.

Chloroform is still more restricted, so far as medicines are concerned. It is made use of to dissolve phosphorus for the purpose of making phosphorus pills: also for preparing a solution of gutta-percha as a coating to abraded surfaces.

Benzin, benzol, carbon disulphide, acetone, amyl alcohol, methyl alcohol, oils, and many other liquids are exceedingly useful as solvents for chemical and technical purposes, but are unsuited for most medicines.

Alkalies and *acids* are also very efficient solvents, but in most cases they enter into combination with the substance dissolved, and are therefore, under those circumstances, not true solvents.—CHARLES RICE.

SOLVEOL.—This is a neutral concentrated solution of cresylic acid with sodium cresotate. It contains 10 per cent. of free cresols. It is a dark-coloured liquid, readily miscible with water and having a not unpleasant odour suggestive of carbolic acid. It is a good *antiseptic* in solutions of from 0·1 to 0·5 per cent. It has the advantage over creolin of not clinging to the hands or instruments in gummy masses.

SOLVINES.—See POLYSOLVES.

SOMATOSE, a German proprietary meat preparation, seems to consist substantially of about equal parts of deutero-albumose and hetero-albumose, with traces of peptone (*Lancet*, February 2, 1895). It is a pale yellowish powder, readily soluble in water, and having the nutritive value of six times its weight of beef. It is employed as a food in amounts of from ½ to 1 oz., in milk, cocoa, or soup (Coblentz), chiefly in cases of impaired digestion. Dr. Hans Taube, of Madrid (*Wiener klinische Rundschau*, December 29, 1895; *New York Medical Journal*, January 25, 1896), gives brief histories of a case of *ulcer of the stomach* and one of *cancer of the stomach* in which he has observed great benefit from the use of somatose. The patient with ulcer was fully restored to health, and the subject of cancer was much benefited. Dr. Taube states also that he has used somatose with advantage in *chlorosis, anæmia, phthisis, typhus, pericarditis, neurasthenia*, the *mercurial cachexia*, and *agalactia*. Its effect, he says, was particularly striking in the case of mercurial cachexia.

Dr. Gerdes and Dr. Susewind (*Deutsche Aerzte-Zeitung*, October 15, 1895; *New York Medical Journal*, January 4, 1896) have found somatose of special utility in *irritation of the gastro-intestinal mucous membrane*. They cite a case of severe *gastro-enteritis* in which all other liquid foods given in larger quantities had been vomited, while the employment of a strong solution of somatose (a heaping teaspoonful to three tablespoonfuls of water) not only tided the patient over a critical period of fourteen days, but exerted a very favourable influence upon his strength. Although the somatose solution was administered, at first three times, then four or five times daily, for a period of fourteen days, the patient never manifested repugnance, and even during the stage of convalescence relished its addition to soups or other foods. As an element in the ordinary diet of *anæmic* and *nervous* persons it proved of great value, being well borne and perfectly assimilated for a long time. In the cases observed by the authors an increase of strength occurred within a comparatively short time, and in *chlorosis* a rapid disappearance of the *menstrual disturbances, headache, vertigo*, etc., was noted. In some instances after the use of somatose a remarkable improvement took place in the digestion, and all the patients experienced an increase of appetite which persisted after the discontinuance of its use. In the above-mentioned solution somatose, in the authors' opinion, seems pre-eminently indicated as a nutriment in *cancer of the stomach and œsophagus*, where only small quantities of food can be ingested, or after *gastrostomy*, since its ready assimilability precludes the occurrence of digestive disturbances.

SOMNAL, $C_7H_{12}Cl_3O_2N$, or $CCl_3-C\begin{matrix}OC_2H_5\\H\\NH.COOC_2H_5\end{matrix}$, is a German patented preparation termed also *ethylated chloralurethane*, a clear, colourless liquid of a pungent

taste. It is used as a hypnotic. M. Marandon de Montyel (*Annales médico-psychologiques*, August, 1893; *Presse médicale*, March 23, 1895) recommends its employment in *acute melancholia*. Not only has it produced sleep, in his experience, but even recovery after three or four weeks of its daily employment in amounts of from 75 to 105 grains. In other subjects, he says, somnal provokes a certain degree of intoxication before sleep comes on, agreeable dreams during sleep, and a slight excitation and gaiety on awakening.

Khmelewsky has found that there is a very marked amelioration in cases of melancholia. He also says that in healthy subjects doses of from 38 to 45 grains give rise, at first, to a slight intoxication; but in half an hour after its administration sleep follows, although it is often interrupted. From 45 to 60 grains produce very profound sleep. On awakening, there is no disagreeable sensation, as is the case when trional or sulphonal is used. Khmelewsky has not observed any particular gaiety or excitement in the patients, as M. Marandon de Montyel had alleged. In melancholia, as well as in *simple insomnia*, he says, somnal always acts better than any other hypnotic, for not only does it induce an agreeable and profound sleep, but it is not accompanied by disagreeable subjective symptoms on awakening; it causes no depression, as sulphonal and trional do; it does not give rise to the motor troubles so frequently seen after the use of chloralose; and it never produces cardio-pulmonary accidents. It is only in cases of gastro-intestinal disorders that the use of somnal is contra-indicated, as it may aggravate dyspepsia and diarrhœa.

The usual hypnotic dose of somnal is from 15 to 30 minims, well diluted.

SOPORIFICS.—See HYPNOTICS.

SORBEFACIENTS are agents which promote absorption. They may be divided into two classes: First, those which assist the lymphatics in the removal of morbid or inflammatory products; and, second, those which promote the imbibition of nutritive or medicinal material into the system, either by stimulation of the lymphatics or by furnishing excipients for less readily absorbable materials.

The first class is very large, and includes drugs of very diverse action, but as the great majority have already been considered, grouped under headings which denominate their mode of action, such as cathartics, counter-irritants, diaphoretics, diuretics, etc., the present article will be devoted to those agents whose sorbefacient power has been empirically determined, while we are still ignorant of the manner in which that power is exercised. These agents promote the absorption of morbid products, and this fact furnishes a basis upon which to group them, but this common factor or result is not the most prominent feature of the action of each one, and it is not likely that it is attained in the same way by the different members of the group. They alter morbid processes of nutrition in an unknown manner, and are therefore known as alteratives; they also possess the power of causing the disintegration of pathological products and of promoting the absorption of the *débris*, whence they have been termed discutients or resolvents.

The absorption of an inflammatory product may sometimes be hastened by inducing a modification of the surrounding circulatory conditions, thus assisting the efforts of the lymphatics to remove an abnormal deposit by overcoming an obstruction to their action. For example, in *parametritis* the sluggish local circulation is stimulated to a healthier activity by the use of *vaginal douches of hot water*, which enable the lymphatics to resume a more normal activity, and to commence the removal of the inflammatory exudation. A similar but briefer effect is produced by the use of cold instead of hot water, and in some conditions the *alternate use of heat and cold* may be the most efficient means for relieving the inflammatory stasis. In *plastic iritis*, the writer is convinced, the systematic use of applications of hot water to the eye is of material value in promoting the resolution and absorption of the exudate, and in influencing the course of the disease, even when not indicated by pain. The absorption of *hypopyon* may also be hastened by the use of hot water, and reparative action may sometimes be induced in an *ulcer of the cornea* by the same means.

The principal drugs which facilitate the absorption of morbid products are *mercury* and *iodine*, particularly in the form of the iodides. We know that for a great many years these drugs have been employed to cause the disappearance of certain inflammatory deposits which have proved not amenable to other, possibly better understood, lines of treatment, and that, in spite of an immense amount of study which has been devoted to them, we are as ignorant as our fathers were of their modes of action.

The systemic action of mercury has been already thoroughly discussed. We know that it is very complex; that the drug increases the activity of glandular structures and augments the quantity of almost every secretion; that it tends to induce solution of imperfectly organized structures, particularly when they are the results of inflammation; and that this solvent power is most strongly exhibited when the morbid product is the result of syphilis. At the same time observation teaches us that mercury is not equally efficacious in all the forms or stages of syphilis, but that certain products of syphilitic inflammation are more amenable to the iodides, while still others respond more quickly to the combined use of the two drugs. Mercury does not confine its action to neoplasms of syphilitic origin, but promotes to a greater or lesser degree the elimination of other imperfectly organized tissues from the system. From these facts we deduce the conclusion that in some manner mercury acts to break down newly formed tissue which is lacking in certain qualities of organization, and to reduce it to a detritus which can be carried away by the lymphatics. At the same time it

probably increases the activity of the lymphatics themselves, and by stimulation of the glandular system hastens the work of elimination.

Iodine is a general excitant of the vital actions, especially of the lymphatic and glandular system. Its principal use is perhaps as a counter-irritant, and as such it is not infrequently used over the site of *inflammatory effusions* or *deposits*. The result is not entirely due to its counter-irritant action, because some portion of the drug is absorbed and aids in the elimination of the morbid product. Administered internally, it seems to find its greatest efficacy in reducing *glandular enlargements*, such as *goître* and *enlarged and indurated liver, spleen, mammæ*, or *testes*. It is also useful in promoting the absorption of *inflammatory effusions in the great lymphatic spaces*, such as the pleural and peritoneal cavities. When administered in the form of the iodides, it shows a distinct eliminative power over certain neoplasms, particularly young *connective-tissue growths of syphilitic origin* which do not respond well to the influence of mercury.

Although we can not explain its *modus operandi* any better than we can that of mercury, there is reason to believe that it is not the same. It is probable that the principal feature of its action is to stimulate the entire lymphatic system and so encourage the absorption of certain imperfectly organized newly formed tissue. It does not possess the power of modifying the local circulation, and does not materially affect the lymphatics of a part which is in a state of vascular congestion from either active or passive inflammation, but when the circulatory obstruction has been removed it assists the lymphatics in their effort to remove the products of the inflammation and restore the tissues to their normal condition. Thus the sorbefacient power of iodine is seen to be in all probability greater than that of mercury, but it is not the only one which it possesses. The study of the results produced by its use reveals evidence that it also has a power to cause disintegration of certain exudates and neoplastic tissues, and that these tissues differ from those which are broken down by the action of mercury. It is effective in some cases where mercury is not, and again may fail where the other will succeed. The use of the two drugs combined is frequently of greater efficiency than that of either alone, as is demonstrated in certain syphilitic conditions as well as in non-syphilitic affections of the skin which originate in excess of nutrition. If to these two drugs we add *arsenic*, and form what is known as *Donovan's solution*, we obtain the combined action of three agents, each of which acts apparently in a different way to destroy neoplastic tissue, while two exert a sorbefacient action, thus forming a very powerful means for the removal of such growths.

Atrophy of the mammæ and of the testicles has been ascribed to iodine, but, if authentic, such cases are very rare. No drugs of which we have knowledge can break down or cause the lymphatics to absorb hypertrophies of normal tissue or the products of slow, progressive parenchymatous inflammation. Neither the connective tissue which distorts the valves of the heart in endocarditis nor that which is present in spinal sclerosis can be removed by these means. A low grade of organization is necessary for such removal of tissue.

In cases of *chronic poisoning with lead* or *mercury* the elimination of these drugs is powerfully aided by the iodides, which convert the deposited metal into soluble combinations and hasten their excretion.

In addition to these two principal drugs a few other alteratives of minor importance should be mentioned, although it has not been satisfactorily determined that they have any marked sorbefacient power.

Sarsaparilla and *guaiacum* have popular reputations as alteratives, and some practitioners consider them useful as adjuvants to mercury in promoting the absorption of certain pathological products. On the contrary, other practitioners declare themselves doubtful, not only in regard to these drugs' possessing sorbefacient powers, but in regard to their having any medicinal virtue whatever.

If any stimulation of the lymphatic system is produced by *iodoform* and *iodol*, it is probably referable to the iodine which enters into their composition, but the effect of iodoform upon the general system is so different from that produced by iodine as to cause a reasonable doubt in regard to the production of such stimulation.

Ichthyol has been recommended as "a local alterative and an anodyne resolvent" in certain *skin diseases*. Possibly its effect upon these morbid conditions is due to stimulation of the lymphatics, but too little is known of its action upon the general system to permit of an authoritative statement whether this is or is not a correct theory.

Occasionally other drugs produce effects which are difficult of explanation in any other way than that they promote absorption. Thus, the application of *nitrate of silver, sulphate of copper*, and other remedies to *trachoma* induces an absorption of the trachomatous tissue which can hardly be satisfactorily explained by their caustic or astringent effect.

The sorbefacients of the second class are agents by means of which the imbibition of nutritive or medicinal material into the system is aided or determined, through the skin or mucous membrane, exclusive of the processes of digestion. They may be divided into two sets—those which mechanically promote absorption and those which serve as menstrua to conduct drugs more readily to the lymphatics. The *hot-water bath* and the *vapour bath* are possibly the most important of the first class. By them the surface of the skin is cleansed from extraneous substances, the pores are dilated, and the tissues are relaxed, while the circulation and the activity of the lymphatics are increased, rendering absorption more readily accomplished. This method of medication is largely used in sulphur and mercurial baths as well as in those containing other drugs.

Massage stimulates the circulation by the compression of the small blood-vessels with the muscular tissue and skin of the part operated on, and determines a more active circulation and therefore increased activity on the part of the lymphatics. At the same time the medicament is mechanically pressed into the pores of the skin and into close propinquity to the lymphatics, thus rendering its absorption easier and greater in amount. The combined use of the bath, massage, and an oily excipient for the drug is a very efficient method of securing rapid absorption through the integument. Superficial irritation of the skin may be produced by the application of certain counter-irritants, such as heat, hot water, and mustard, and after their removal, if absorbable medicaments are applied, they will be taken up by the lymphatics more readily than usual, on account of their stimulation by the locally increased circulation.

The absorption of certain drugs, such as cocaine or aconite, through the skin may be accomplished by means of the *galvanic current*. The positive electrode is moistened with a solution of the drug which it is desired shall pass through the skin, applied to the place where the action is desired, and, placing the negative electrode elsewhere on the body, a moderate current is turned on. The drugs can be carried deeper into the tissues by increasing the porosity of the skin with very fine needles, but the punctures must be very fine, not large enough to be visible to the naked eye. According to Dr. Corning, the periosteum of the bones of the arm can be thus anæsthetized with cocaine. (See also under ELECTRICITY, vol. i, p. 361.)

The remaining set of sorbefacients, which act as excipients for less readily absorbed materials, consists mainly of fatty and oily substances of which ointments and similar preparations are made. *Lanolin*, *cacao butter*, and *oleic acid* possess peculiarly efficient powers of penetrating through the skin, and deserve special mention. The oleates are solutions of certain drugs as bases in oleic acid. They penetrate the skin much more readily than the corresponding ointments, and thus introduce the drugs they contain more quickly into the general circulation. The principal objection to their use is that they are apt to be irritating and, when applied with friction, may even cause pustulation of the skin. Lanolin penetrates the skin probably the most rapidly of all oils or fatty substances, and at the same time is non-irritating and can be with advantage applied with friction. For these reasons lanolin is the best excipient of this class when rapid absorption of a certain drug is desired. Oleum theobromæ, or cacao butter, penetrates the skin nearly as well and is used in the manufacture of cosmetics, as it is a fine emollient and does not leave a greasy appearance. Although solid at the usual temperature of the air, it melts at from 86° to 95° F., below the temperature of the body. On account of its usual consistence, low melting point, and great absorbability, it is an almost ideal substance for the manufacture of suppositories, for which it is mainly used. It dissolves in the cavity of the body in which it is placed and penetrates the mucous membrane, carrying with it a portion at least of the medicament with which it has been charged.

MATTHIAS LANCKTON FOSTER.

SORBINOSE. See under SUGAR.

SORREL.—See OXALIS.

SOY, SOYA BEAN.—See SOJA HISPIDA.

SOZAL, or *aluminum paraphenylsulphonate* $(C_6H_4(OH)SO_3)_3Al$, is an *astringent* and *antiseptic* crystalline powder soluble in water, in glycerin, and in alcohol. It is used in a 1-per-cent. solution as a wash for *suppurating surfaces* and as an injection in *cystitis* and *tuberculous abscesses*.

SOZOIODOL, *sozoiodolic acid*, or *diiodoparaphenolsulphonic acid*. $C_6H_2I_2(OH)SO_3H$, is a crystalline body readily soluble in water, in alcohol, and in glycerin. Sozoiodolic acid, mercury sozoiodolate, potassium sozoiodolate, sodium sozoiodolate, and zinc sozoiodolate are used as *antiseptics*. In dispensing, sodium sozoiodolate is furnished when "sozoiodol" is prescribed without qualification.

Mercury sozoiodolate, or *sozoiodol-mercury*, $C_6H_2I_2.SO_3.O.Hg$, is an orange-yellow powder soluble in salt water. It contains 41 per cent. of iodine. It is used topically in *parasitic skin diseases* and in *syphilitic ulcers*, in an ointment of the strength of from 2 to 10 per cent. or in the form of a dusting powder consisting of from 2 to 10 per cent. of the drug diluted with talc or powdered starch.

Potassium sozoiodolate, or *sozoiodol-potassium*, is a white, odourless powder soluble in 50 parts of water, insoluble in alcohol. It is used as an antiseptic dusting powder, pure or diluted with from 3 to 10 times its weight of talc or starch, in *suppurating wounds*, *ulcers*, etc., as an odourless and non-poisonous substitute for iodoform.

Sodium sozoiodolate, or *sozoiodol-sodium*, which occurs in white crystals, is soluble in 14 parts of water. It is used for the same purposes as the potassium compound. Moreover, Dr. S. Schwarz (*Wiener klinische Wochenschrift*, 1895, No. 43; *Deutsche Medizinal-Zeitung*, August 10, 1896) recommends the following treatment, which he considers both prophylactic and curative of *diphtheria:* In the case of children under two years old he insufflates the nasal and pharyngeal cavities with this powder every four hours:

℞ Finely powdered sodium sozoiodolate	45	grains;
Flowers of sulphur	90	"
Saccharin	15	"

M.

For children from two to four years old he prescribes equal parts of sodium sozoiodolate and flowers of sulphur, with the addition of saccharin; for those over four years old, sodium sozoiodolate with a little saccharin without the sulphur.

Zinc sozoiodolate, or *sozoiodol-zinc*, a white crystalline powder soluble in 20 parts of water, is used like the potassium salt.

SOZOLIC ACID.—See ASEPTOL.

SPANISH FLIES.—See CANTHARIDES.

SPARTEINE, $C_{15}H_{26}N_2$, is an alkaloid prepared from the flowering tops of *Cytisus Scoparius*, or the common broom-plant. It is a colourless, oily liquid, possessing a very penetrating odour, and has a bitter taste. It is found in Asia and has been propagated in the United States. The sulphate, *sparteinæ sulphas* (U. S. Ph.), is freely soluble in water.

The physiological action of sparteine is that of a stimulant to the muscular substance of the heart. The pulse may also be increased in frequency after its administration, but there is rarely deviation in the arterial tension. Upon the spinal reflex centres it is sedative; less so to the circulatory apparatus. In moderate doses it may exert a narcotic influence. As the result of toxic doses, somnolence appears, attended with extreme frequency of the pulse and respiration; intense dyspnœa with feebleness of the heart's action comes on and the cardiac cycle may become arrhythmical. Nausea, vertigo, and vastly diminished reflex excitability of the spinal cord follow, and death ensues, sometimes with convulsions, by paralysis of the respiratory centre in the spinal cord. In conditions of health, sparteine is not a diuretic.

The therapeutic uses of sparteine are as a *diuretic* and *cardiac stimulant*. In cases of pronounced *anasarca*, where this condition is not due to renal or splenic disease, sparteine assists in the removal of the abnormal fluid by acting upon the kidneys and as a hydragogue cathartic upon the intestines. It is inferior in this respect to other diuretic agents, but in their absence may be safely employed, usually with good results. Sparteine may be given, in the absence of digitalis, in cases of *impaired heart action* with diminished quantity of urine, sometimes with a gratifying sequel.

[Dr. Gilbert G. Cottam (*Therapeutic Gazette*, November, 1896; *New York Medical Journal*, November 28, 1896) states that he has employed sparteine sulphate in a number of cases as a *heart stimulant during anæsthesia* with very positive results, and the beneficial effect of the drug has been clearly shown in nearly every instance. He refers to Bevill as having used it in doses of a fifth of a grain by the mouth, given thirty minutes before the administration of chloroform. He describes two cases in which the patients did well throughout prolonged anæsthesia. Langlois and Maurange (*Semaine médicale*, August, 1894), he says, give from 0·5 to 0·6 of a grain of sparteine sulphate and $\frac{3}{20}$ of a grain of morphine hypodermically fifteen minutes before the administration of an anæsthetic. They have done this a hundred and twenty times on the human subject. In many of the cases the patients suffered from heart disease or had to undergo prolonged operations, such as laparotomy, kelotomy, and reduction of dislocations. In all of them the heart beats continued full and perfectly regular. Dr. Cottam's mode of procedure is to inject hypodermically $\frac{1}{10}$ of a grain of sparteine sulphate ten minutes before the anæsthesia is begun. Then, if the operation is protracted, $\frac{1}{15}$ of a grain is injected during its progress. These doses have been found ample to secure the desired effect, although they are much smaller than is generally considered necessary. Dr. Cottam gives an account of seven cases to illustrate the points enumerated. Sparteine sulphate was used in every instance in the manner described, and the patients themselves, from various causes, were such as would be peculiarly susceptible to the depressing influence of chloroform, and hence admirably adapted to demonstrate the properties of sparteine. A study of these cases and many others of a minor nature, he says, has caused him to form these conclusions: 1. That in sparteine sulphate, administered hypodermically before the beginning of anæsthesia, in the dose of $\frac{1}{10}$ of a grain, repeated according to the nature of the operation and the condition of the patient, we have a safe, efficient, and prompt heart stimulant in chloroform narcosis. 2. That it is not necessary either to combine it with morphine or to use it in larger doses than those specified. 3. That, other things being equal, there is less shock and there is prompter reaction with its use.]

The action of the drug upon the heart muscle—probably through the cardiac ganglia—is more rapid than that of digitalis, and its effect, in moderate dose, lasts for from four to six hours. In *diseases of the myocardium* or of the *valves of the heart*, when prompt action is desired, sparteine answers the purpose. Sée has recommended the drug highly in *mitral* and *aortic regurgitation* and in *stenosis of the mitral valve*. He reports results particularly gratifying in cases in which the insufficiency of the aortic valve was accompanied by a rapidly beating, tumultuous heart. In *asthma* of *cardiac origin* the drug has been praised. It is said that the vascular symptoms of *Graves's disease* may be alleviated by the use of sparteine. *Functional disturbances of the heart* seem to yield to the influence of the drug. As an *antipyretic*, it has been used successfully by Geley, by cutaneous application, in the evening rise of temperature in *phthisis*, in *measles*, and in *scarlatina* (cited in *New York Medical Journal*, February 22, 1896).

Sparteine may be administered in solution in doses of from $\frac{1}{30}$ to $\frac{1}{4}$ of a grain. As the necessity arises, the dose may be increased to 2 grains. For rapid stimulation of the heart, the sulphate may be used. Its free solubility in water renders it available for subcutaneous employment. The dose of sparteine sulphate is from $\frac{1}{10}$ to $\frac{1}{2}$ a grain. Tablets of the salt for hypodermic use are in the market.

SAMUEL M. BRICKNER.

SPASMOTIN, SPASMOTOXINE, or *sphacelotoxine*, or *sphacelinic acid*, is a principle obtained from ergot, said to have the formula $C_{20}H_{21}O_8$ and to exert the medicinal actions of ergot. According to Dr. C. Jacobj, of the Pharmacological Institute in Strassburg (cited in the *Cincinnati Lancet-Clinic*, August 4, 1894), it has been used satisfactorily in Freund's clinic, in doses of 1½ grain. Too little is as yet

known about it, however, to warrant its general employment.

SPEARMINT.—See MENTHA VIRIDIS.

SPECIES.—These preparations, still official in several European pharmacopœias, are mixtures of dried and powdered vegetable substances to be used in making infusions, decoctions, etc.

The *species aromaticæ* (Ger. Ph.) consist of 2 parts each of peppermint leaves, serpyllum, thyme, and lavender flowers, and 1 part each of cloves and cubeb.

The *species diureticæ* (Ger. Ph.) are equal parts of levisticum root, ononis root, licorice root, and juniper berries.

The *species emollientes* (Ger. Ph.) consist of equal parts of coarsely powdered althæa leaves, mallow leaves, melilotus, chamomile, and flaxseed.

The *species laxantes* (Ger. Ph.) are made by moistening with a little water 16 parts of senna leaves chopped moderately fine, then sprinkling over them as evenly as possible 4 parts of potassium bitartrate in fine powder, and, when the mixture has become dry, adding 10 parts of elder flowers and 5 parts each of fennel and anise.

The *species lignorum* (Ger. Ph.) consist of 50 parts of guaiac wood, 10 each of sassafras wood and licorice root, and 30 of the root of *Ononis spinosa*.

The *species pectorales* (Ger. Ph.) contain 8 parts of peeled althæa root, 4 parts of the leaves of *Tussilago Farfara*, 3 parts of licorice wood, 2 parts each of aniseed and mullein flowers, and 1 part of orris root.

SPECIFICS.—Remedies which cure certain diseases in some way not indicated by their physiological action are spoken of as specifics. They are few in number, the most notable examples being mercury for the cure of syphilis and cinchona for the cure of malarial disease. It is now considered certain that cinchona and its alkaloids prove curative in malarial affections by their action on the *Plasmodium malariæ*, and it is probable that all specifics, among which may be classed the antitoxines, act by destroying the energy of the germ or its products on which the particular disease depends.

SPERMACETI, the *cetaceum* of the pharmacopœias, is employed in making cerates and ointments, for which its freedom from irritating properties and its consistence render it peculiarly valuable. Spermaceti ointment, *unguentum cetacei* (Br. Ph.), contains, in addition to spermaceti, white wax, almond oil, and benzoin, and is rather more elegant than ordinary simple ointment. Spermaceti cerate, *ceratum cetaceum* (U. S. Ph.), is essentially the same as the ointment except that it contains no benzoin.—RUSSELL H. NEVINS.

SPERMINE.—This is a natural alkaloid, a leucomaine, found in the form of a double phosphate of spermine and calcium in the testicle, in the ovary, in the thyreoid gland, in the thymus gland, in the lymphatic glands, in the pancreas, in the marrow of bone, in the blood, in the yolk of egg, etc. The spermine now used in medicine is generally in the form of a 2-per-cent. solution of the hydrochloride, of which from 8 to 16 minims are administered by subcutaneous injection once a day. Dr. Alexander Poehl, of St. Petersburg, regards spermine as a most efficient restorative of vigour, acting as an *antitoxine* in cases of *self-poisoning by absorption from the intestines* and by increasing the oxidizing powers of the blood and the tissues. Dr. George E. Krieger, of Chicago (*American Therapist*, June, 1895), who takes the same view, has reported the beneficial action of spermine in *asthma, anæmia, dyspepsia, chorea, diabetes, Bright's disease, neurasthenia, neuralgia, locomotor ataxia, syphilis, chronic ulcers,* and *tuberculous* and other *infectious diseases*. The indications for the use of spermine are the same as for that of testicle juice (see vol. i, page 73).

SPHACELOTOXINE.—See SPASMOTIN.

SPIGELIA (U. S. Ph.), or *pink root*, is the rhizome and small roots of the *Spigelia marilandica*, an American plant which is used in medicine to cause the expulsion of the *Ascaris lumbricoides*, or roundworm. It is usually employed in the form of the fluid extract, *extractum spigeliæ fluidum* (U. S. Ph.), of which the dose for an adult is from 1 to 2 fl. drachms, although the powdered drug is sometimes used in doses of from 1 to 2 drachms, as well as an infusion of ½ an oz. in a pint of water, taken at one dose. In larger doses it is somewhat *cathartic*, and in overdoses gives rise to vertigo, amblyopia, dilatation of the pupils, twitching of the face, and sometimes general convulsions. Death has been reported to have followed excessive doses. As there is no physiological antidote, the treatment in cases of poisoning must be conducted upon general principles. The preparatory treatment mentioned under ANTHELMINTHICS should be followed in all cases, and it is usual to administer a cathartic simultaneously, senna or calomel being the one usually selected.

Spigelia anthelminthica is a native of tropical America, where it is employed for the same purposes as *Spigelia marilandica*, but it is credited with being rather more active and more dangerous to life.—RUSSELL H. NEVINS.

SPINAL-CORD EMULSION.—See under ANIMAL EXTRACTS AND JUICES (vol. i, page 82)

SPINANTS.—This "barbarous vernacular," as Stillé terms it (*Therapeutics and Materia Medica*, vol. ii, page 147), has been excluded from all the recent medical dictionaries and works on materia medica and therapeutics. It is an old term formerly used to designate remedies now known as the excitomotors, including principally vegetable substances containing the alkaloids strychnine and brucine, but by some made to include the oxytocics, which apparently stimulate the muscular fibres of the womb by their action on the lower portion of the spinal cord. Probably strychnine is the only substance that acts as a stimulant to the entire spinal cord.

JEREMIAH T. ESKRIDGE.

SPIRITS.—In a pharmaceutical sense, these are alcoholic solutions of volatile substances, the latter being solids, liquids, or gases. They are prepared by simple solution, or by distillation, or by a combination of the two.

The spirits prepared from most of the essential oils are used simply for flavouring. Others, like spirit of ammonia, spirit of ether, compound spirit of ether, spirit of camphor, whisky, brandy, etc., are used chiefly as stimulants. The most important, and at the same time the most variable ones, as regards strength, are spirit of nitrous ether and spirit of glonoin. The strength of both of these should be controlled by assay, and it should be borne in mind that the former constantly becomes weaker by age. The method of assay is given in the U. S. Ph., and need not, therefore, be repeated here. For spirit of glonoin, however, no reliable method of assay was known when the last U. S. Ph. was published. As the commercial article varies very considerably in strength, and as uniformity in so powerful a drug is highly desirable, the method of assay devised by the writer of this article and recently published by him (*Alumni Journal*, New York, vol. ii, page 183) is briefly described here:

Assay of Spirit of Glonoin.—Into an Erlenmeyer flask introduce 20 c. c. of a normal solution of potassa in absolute alcohol, heat it moderately, and then add to it, in several portions, 10 grammes of the spirit of glonoin to be assayed, finally rinsing the vessel, which contained the latter, with a little absolute alcohol, and adding this to the mixture. Test the liquid with litmus paper to ascertain whether it is still alkaline. If it is not, this shows that the amount of alkali was insufficient to decompose all the nitroglycerin. In this case add another portion (10 c. c. or more) of the alcoholic potassa solution, carefully measured from a burette, and consider this in the final calculation. Place the flask on a water-bath and heat it until the contents begin to boil. Then stop it and set it aside to cool. Now pour off the clear, pale-coloured solution from the coloured crystalline crust adhering to the bottom of the flask, wash the latter with alcohol, add the washings to the other liquid, then a little phenolphthalein solution, and determine the remaining excess of alkali with normal acid. Deduct the amount of this excess from the total volume of normal alkali employed in the assay, and multiply the remainder by 0·0755. The product will be the percentage, by weight, of nitroglycerin (glonoin) present in the spirit.

CHARLES RICE.

SPLENIC EXTRACT.—Dr. W. Cohnstein, of Berlin (*Allgemeine medicinische Central-Zeitung*, 1896, No. 43; *Therapeutische Wochenschrift*, June 14, 1896), having found, like Danilewsky, that the use of a watery extract of the ox's spleen, whether given by the mouth or subcutaneously, gave rise to a notable increase in the number of the red blood-corpuscles in dogs and rabbits, has employed it therapeutically. He reports upon its use by several physicians in twenty-three cases. In one of them the disease was *leucæmia;* the others were examples of *anæmia* or *chlorosis.* In the case of leucæmia there was only a transitory effect observed, not really therapeutical. On the other hand, in the majority of the cases of anæmia and chlorosis the action of the extract was very striking. The first signs of improvement were seen in the subjective symptoms of *debility, loss of appetite, constipation, headache,* and *dysmenorrhœa.* Objectively, the pallor disappeared, and often there was an increase of the hæmoglobin or of the number of the red blood-corpuscles. In many cases the patients gained flesh notably. In many others there were no objective signs of improvement. In no instance was any unpleasant effect observed.

The splenic extract employed by the author was one known by the trade name of *eurythrol.* It is a watery extract to which salt has been added, partly to preserve it and partly to give it a better flavour. It is described as resembling Liebig's beef extract. The amount to be given daily is from one to two teaspoonfuls, dissolved in hot water.

SPONGE, as it occurs in the shops, is rarely in proper condition for either medical or surgical purposes, containing as a rule more or less sand and calcareous matter and being of an objectionable dark colour. Sponges should be soaked for a day or two in a 3-per-cent. solution of commercial hydrochloric acid, to remove the calcareous matter, and subsequently washed a number of times in fresh water. To bleach them, the method is to soak them in a 1-per-cent. solution of potassium permanganate for several hours and, after rinsing, submit them to a 2- or 3-per-cent. solution of oxalic acid, the last traces of which must be removed by repeated washings. Chlorine or a dilute solution of sulphurous acid is sometimes used to bleach them, but the texture of the sponge is more apt to be affected than when the above-described method is employed. To render them aseptic, as is necessary when they are to be used as absorbents of blood, pus, etc., it is necessary to soak them for at least twenty-four hours in a 5-per-cent. solution of carbolic acid, and after their removal from that to allow them to remain in water sterilized by heat for two days, and then to immerse them in a carbolic-acid solution to destroy any micro-organisms which may have escaped the first part of the process. When they are prepared in this manner it is fairly certain that they are free from disease germs and that they retain their absorbent properties. Heat, either dry or moist, injures them greatly, as do also all the commonly employed antiseptics, such as corrosive sublimate. It is a common practice to attempt to disinfect sponges after having employed them in operations, etc., but it is much wiser to avoid their use a second time, as it is almost impossible to render them entirely aseptic. Sponges of the cheaper grades, provided they are fairly absorbent, are just as useful, and can be destroyed after having been once used, or gauze or absorbent cotton, either of which is easily sterilized, will prove reasonably satisfactory.

Although inferior to skin-grafting, *sponge-grafting*, or the application of very thin sheets of sterilized sponge upon the surface of *unhealthy granulating sores* of large area, will often prove useful in hastening the process of repair and preventing the contraction of the cicatrices. The sponge should be as thin as possible and held in place by light pressure, and antiseptic dressings should be applied. It may require several weeks to insure success in this procedure, but, properly performed, it is usually successful.

Sponge tents may be prepared by winding cord tightly around small pieces of dry sponge, which may or may not be previously impregnated with mucilage of acacia. Before they are to be used the cord is removed. On account of their absorbent properties they are decidedly inferior to tents of laminaria or tupelo wood, except when they are to be impregnated with some medicinal agent. When they are employed to dilate the canal of the cervix uteri the condition of the patient must be watched carefully, as decomposition of the mucus, etc., absorbed by the tent has often occurred, with a resulting septicæmia. By some it is advised that when they are used in that situation it is proper to inclose them in a rubber condom. For tamponing the vagina they are not so suitable as absorbent cotton, but when a single plug is used, as when certain substances are to be retained against the cervix, there is no decided objection to the use of a sponge, provided it is not allowed to remain in position for longer than twelve hours. In *post-partum hæmorrhage* a sponge of fair size, impregnated with *vinegar* and introduced within the uterus, is sometimes effectual in checking the flow of blood, but it should not be permitted to remain for more than an hour or two, lest it should be difficult of removal. Great care should be observed that the sponge is tough, so that no fragments may be detached and remain, for the blood absorbed by them would almost inevitably decompose and give rise to unpleasant results.

When impregnated with a minute amount of glycerin, which may be accomplished by soaking them in a 5-per-cent. solution of that substance, sponges retain their elasticity permanently and may be used to exert moderate pressure upon *varicose veins*, *enlarged breasts*, etc., being held in position by appropriate bandages. (See also under ANTISEPTICS IN SURGERY, vol. i, page 128.)—RUSSELL H. NEVINS.

SPONGIOPILINE. — See under POULTICES.

SPRAYS.—A spray is a fluid, which may hold in solution one or more drugs, reduced to a condition of minute particles by the force of a blast of air or steam. This condition of the fluid is known as atomization; the instrument employed to produce it, as an atomizer.

There are many forms of atomizers on the market, which differ in size and shape according to the purposes for which they are intended to be used or the blast power to be employed, but in all used at the present time the fluid is forced through a tube and as it emerges from the mouth is reduced to a spray by a blast of air or steam. The first attempt to use a spray was made with a syringe which forced the fluid through numerous minute perforations in a plate of metal that closed the objective end of the barrel. This method was unsatisfactory, and the apparatus devised by Sir Benjamin Ward Richardson was a very great improvement. In this the fluid is placed in a receptacle sealed with a stopper which contains two tubes, one extending beneath the surface, the other opening above the surface of the fluid and also at the mouth of the first. The second tube is also connected with the blast apparatus, usually a rubber bulb which is squeezed by the hand of the operator. When air is thus driven through the second tube into the reservoir the pressure forces some of the fluid through the first tube to its mouth, where it is met by a blast of air from the second tube which reduces it to spray.

The form most employed at the present time, and the most generally useful, depends for its action upon a different principle. Two tubes with very fine mouths are placed at right angles to each other. One tube leads into a receptacle containing the fluid which it is desired to atomize, while the other is connected with the blast apparatus. The air driven through the latter tube across the mouth of the former causes a rarefaction of the air within and a consequent rise of fluid in the tube until it emerges and is blown into spray.

The blast is obtained by compression of a rubber bulb, by the liberation of compressed air, or by steam. The hand-ball atomizer is used for many purposes, non-medical as well as medical, is portable, and is familiar to every one, but it is of far less efficacy in most cases where the use of the spray is now considered advantageous than an atomizer which obtains its power from compressed air. In order to obtain a continuous spray with a hand-ball atomizer a second bulb is inserted between the hand ball and the rest of the apparatus. This second bulb dilates as the first is compressed and by its elasticity maintains a steady blast while the first is being refilled with air. A continuous spray of this nature has some advantage over the short, spasmodic action of the single-bulb apparatus, but the disadvantage of inability to stop the spray suddenly is very great and evident. By means of a reservoir of compressed air, a connecting tube, and a cut-off, a spray may be made continuous as long as is desired and stopped in an instant. Steam is sometimes used for the blast. It has the advantage of warmth, but by its presence causes great dilution of the fluid, a fact which must always be borne in mind when a solution is being prepared for atomization by this means.

Sprays have been used to medicate the atmosphere of rooms, to produce *local anæsthesia*, to be inhaled as topical remedies for the mucous membrane of the larynx, trachea, and bronchi, to cleanse the mucous membrane of the nose and throat, and to apply remedial agents to the same.

In the early days of antiseptic surgery rooms

were treated with continuous sprays of carbolic acid from steam atomizers before and during operations, as a precaution against sepsis. Experience and a better knowledge of the principles of antisepsis have demonstrated this precaution to be unwise and useless, so it has been nearly, if not quite, totally abandoned. Sometimes the air of a room is medicated in a similar manner by means of a steam spray, and a patient is caused to remain there a certain number of hours in order that the drug may become absorbed into the system through the skin or the mucous membrane of the respiratory tract. This plan is said to have been used at several of the European spas and in isolated cases elsewhere. Very often great benefit is obtained in affections of the larynx and bronchi by the use of a steam spray in the room where the patient is confined. In these cases, such as *laryngeal diphtheria*, the *dry form of chronic bronchitis*, and especially *capillary bronchitis*, the steam itself is a valuable therapeutic agent, to which the added drugs may perhaps be considered adjuvants. An alkaline spray is the most generally useful, and limewater seems to be the most commonly used. Solutions of common salt, of bicarbonate of sodium, and of other alkalies are also employed. A disinfectant, such as eucalyptus, turpentine, thymol, or carbolic acid, is often added, but the latter should be used very carefully, on account of the danger of poisoning if it is used for any great length of time.

Very volatile substances, like ether or rhigolene, when driven in the form of a spray against the skin, evaporate so rapidly as to quickly freeze that part of it, deprive it temporarily of sensation, and so produce a condition of local anæsthesia. This means, once extensively employed, has fallen considerably into desuetude since the introduction of cocaine as a local anæsthetic.

For the purpose of inhalation, an atomizer is employed which reduces the fluid to a very fine spray that resembles a cloud. As the mouth and pharynx are filled with this cloud the patient is instructed to take deep inspirations, in the hope that a sufficient quantity of the dissolved drug may be inhaled and may remain upon the diseased mucous membrane to aid it to regain its normal condition. Unless the spray is very fine, very little indeed can penetrate into the larynx, and, though reduced to a cloudlike form, little, if any, penetrates as far as the bronchi; so this method of treatment is usually of little avail except to the mucous membrane of the larynx and the immediately adjacent portion of the trachea. In *acute* and *subacute laryngitis* such sprays of alkaline solutions, resorcin, cocaine, and listerine are of considerable value. Attempts have been made, said by some to have been successful, to treat diseases of the lungs by an exceedingly fine spray through the larynx and down the trachea.

The principal use of the spray is in *diseases of the nose* and *throat*. In general terms, the objects to be attained are to cleanse the mucous membrane, to render its secretions alkaline, to interfere with the development of pathogenic micro-organisms, and to furnish a protective coating which will prevent too rapid evaporation from its surface. Alkaline sprays not only render the secretions of the mucous membrane alkaline, but also augment their amount, and are therefore most useful for the purpose of cleansing. Probably the most widely known solution used for this purpose is that known as Dobell's, the formula of which is:

℞ Borax,
Sodium bicarbonate, } each .... 8 grains;
Carbolic acid ..... 4 "
Glycerin ..... 2 fl. drachms;
Distilled water, enough to make 4 fl. oz.
M.

A much less irritating solution for the same purpose is that known as Seiler's, the original formula of which was as follows:

℞ Sodium bicarbonate, } each ... 8 drachms;
Borax,
Sodium benzoate, } each ..... 20 grains;
Sodium salicylate,
Eucalyptol, } each ..... 10 "
Thymol,
Menthol ..... 5 "
Oil of wintergreen ..... 6 drops;
Glycerin ..... 8½ fl. oz.;
Alcohol ..... 2 "
Water, enough to make ..... 16 pints.
M.

The essential ingredients of this solution are usually dispensed in tablet form, on account of the much greater convenience, but the proportions and even the constituents of the tablets which are sold as Seiler's vary to such a degree that no certain formula can be given. To make tablets conforming to the formula given above, omit the glycerin, alcohol, and water, add 10¾ drachms of sodium chloride, mix thoroughly, and divide into 128 tablets. One tablet is dissolved in 2 oz. of water for use as a spray.

The following formula of a Seiler's tablet to be found on the market shows how wide a variance exists:

℞ Borax,
Sodium chloride, } each .... 5 grains;
Menthol,
Thymol, } each ..... $\frac{3}{60}$ of a grain;
Oil of eucalyptus ..... $\frac{3}{60}$ of a minim;
Oil of wintergreen ..... $\frac{3}{100}$ " "
M.

Frequently after cleansing the mucous membrane with this solution it is advisable to spray it with an oily solution to form a protective coating. In cases where stimulation is desirable, a solution of eucalyptol, thymol, and menthol in a pure hydrocarbon oil, like albolene, is very useful. In *acute coryza* this solution, sprayed into the nostril, sometimes acts like a charm to lessen the congestion of the mucous membrane and relieve the feeling of oppression. It is also useful in *simple chronic rhinitis*. In *atrophic rhinitis* it is usually a pleasant application for the patient and relieves many of the disagreeable symptoms for a time, though it can hardly be said to be curative.

In all of the above-mentioned solutions drugs are included which tend to repress the development of pathogenic micro-organisms, but in certain diseases, such as *diphtheria* and *croup*, sprays of *peroxide of hydrogen* or of *bichloride of mercury* are recommended. In using the latter, special care must be taken that the spray is fine, because a coarse spray is of less use and sometimes harmful by inducing absorption of a too great quantity of the drug when it is used for some time.

As a prophylactic against diphtheria, some authors recommend the daily use of the following throat spray, particularly for persons who are suffering from nasal catarrh:

℞ Listerine..... 1 fl. drachm;
Boric acid..... 6 grains;
Glycerin..... 1 fl. drachm;
Water, enough to make 1 fl. oz.
M.

MATTHIAS LANCKTON FOSTER.

SPURGE.—See *Euphorbia pilulifera*, under EUPHORBIA (vol. i, page 401).

SQUILL, *scilla* (U. S. Ph., Br. Ph.), *bulbus scillæ* (Ger. Ph.), is the bulb of *Urginea* (*Scilla*) *maritima*, a liliaceous plant. It is possessed of *expectorant*, *diuretic*, *emetic*, and *cathartic* properties, but is used only when the first two are indicated. As an expectorant, it is indicated in *chronic bronchitis*, when the mucus is tough and viscid, and in *acute bronchitis*, when the signs of congestion of the mucous membrane have subsided. When, in the last-named affection, the expectoration is scanty it is desirable to combine with the squill a nauseant expectorant, such as ipecac, and, on the other hand, when it is profuse, a stimulant expectorant is useful. Squill has been employed to some extent in *croup*, on account of its emetic and expectorant properties, but it is hardly to be commended.

As a diuretic, it is contra-indicated whenever there is any inflammatory process occurring in the kidneys, and it would be safer to restrict its employment to cases of *cardiac dropsy*. It is usual to combine with it one or another of the preparations of digitalis when it is used as a diuretic. In overdoses it purges actively, and paralysis and convulsions may ensue. The dose of the drug itself is from 1 to 2 grains; that of the vinegar, *acetum scillæ* (U. S. Ph., Br. Ph., Ger. Ph.), from 15 to 40 drops; that of the fluid extract, *extractum scillæ fluidum* (U. S. Ph.), 2 to 3 minims; and of the syrup, *syrupus scillæ* (U. S. Ph., Br. Ph.), from 40 to 60 drops. The compound syrup, *syrupus scillæ compositus* (U. S. Ph.), contains about a grain of tartar emetic in the ounce, also senega, and is a very useful expectorant mixture except for infants and persons of low vitality. It may be given in doses of from 10 to 30 drops.

[The dose of the tincture, *tinctura scillæ* (U. S. Ph., Br. Ph., Ger. Ph.), is from 10 to 20 minims; that of the oxymel, *oxymel scillæ* (Br. Ph., Ger. Ph.), is a teaspoonful for adults (from 5 to 20 drops for infants) as an expectorant, and a teaspoonful, given in fractional amounts at short intervals, as an emetic for children. The dose of the compound squill pill, *pilula scillæ composita* (Br. Ph.), is from 5 to 10 grains; for the *pilula ipecacuanhæ cum scilla* (Br. Ph.), see vol. i, page 543.]

RUSSELL H. NEVINS.

STANNUM.—See TIN.

STAPHISAGRIA (U. S. Ph.), *staphisagriæ semina* (Br. Ph.).—The larkspur is a genus of annual or biennial flowering herbs of the natural order *Ranunculaceæ*, and includes many species. The one most used in medicine is *Delphinium Staphisagria*, stavesacre, indigenous to the countries bordering on the Mediterranean and cultivated in many parts of southern Europe. Also the species *Delphinium Consolida*, that is common in central Europe and has been naturalized in the United States, is sometimes used as well as *Delphinium exaltatum* and *Delphinium Ajacis*.

The seeds of *Delphinium Staphisagria*, stavesacre, are most commonly employed. In earlier editions of the U. S. Ph. more prominence was given to the seeds of *Delphinium Consolida*, which were officinally designated as delphinium. The most important ingredient of the seeds is *delphinine*, an alkaloid upon which the virtues of the drug are supposed chiefly to depend. It is insoluble in water; soluble in 21 parts of alcohol, in 11 of ether, and in 16 of chloroform. It is an acrid substance, irritating to the skin and mucous membranes. The seeds contain a non-drying fixed oil in the proportion of from 25 to 30 per cent.

Larkspur seeds have been used in the form of an outward application for the destruction of vermin, both in man and in beasts, from time immemorial, and for this purpose are still somewhat in vogue, though largely superseded by more modern remedies. For such applications the remedy is used either in the form of a lotion or that of an ointment. A decoction made by boiling 1 oz. of the seeds in a pint of water has been employed both for *phtheiriasis* and for *scabies*. A lotion recommended for the destruction of *pediculi capitis* is made by macerating 1 oz. in a pint of vinegar. A tincture in the same proportions is also used, as well as a solution of 1 scruple of delphinine in 2 fl. oz. of rectified spirit. Another effectual preparation is the expressed oil sufficiently diluted with olive oil. According to Balmanno Squire, "a cheap way of preparing the oil for application is to digest the seeds in melted lard and strain while hot. The filtrate is an ointment of the seeds of stavesacre. Two drachms of the bruised seeds should be used to an ounce of lard."

Aside from these uses, larkspur, more particularly *Delphinium Consolida*, has been recommended as a *vulnerary*, and delphinine has been used as a topical remedy for the relief of *neuralgia*, *earache*, and *toothache*. The alkaloid delphinine may be used for this purpose either in alcohol (from 16 to 30 grains to the ounce) or in an ointment (10 to 40 grains to the ounce). The *unguentum staphisagriæ* of the Br. Ph. contains about 10 per cent. of oil of stavesacre.

Internally, the drug is seldom, if ever, now employed, though formerly it was used in *spasmodic asthma*, in *dropsy*, in *gout*, and in *seasickness*, usually in the form of a tincture of the seeds. The dose of delphinine is said to be ¼ a grain, repeated at intervals of three or four hours.—EDWARD B. BRONSON.

STAR-ANISE.—See ILLICIUM.

STARCH.—The *amylum* of the U. S. Ph. is starch obtained from maize; that of the Br. Ph. includes starch from wheat, maize, and rice; and the *amylum tritici* of the Ger. Ph., as the name implies, is wheat starch only.

For the use of starchy substances as articles of food, see the article on FOODS. Starch may be administered freely by the stomach as an antidote in cases of *poisoning with iodine;* also, when irritant preparations of iodine, such as the tincture, have accidentally come in contact with the body or been applied too copiously, their irritating action may be checked by the immediate application of starch. Starch was formerly much employed, in the form of the starch bandage, for encasing a limb in an immovable envelope in cases of fracture, but for this purpose it has now been almost wholly superseded by plaster of Paris. At present starch is chiefly used, finely powdered, as a topical application in *intertrigo* and other forms of superficial irritation of the skin, and to reduce the strength of medicinal powders used locally as dusting powders.

Glycerite of starch, *glyceritum amyli* (U. S. Ph.), is a jellylike mass made with 10 parts of starch, 10 fluid parts of water, and 80 parts of glycerin. Glycerine of starch, *glycerinum amyli* (Br. Ph.), is also a jelly made with 1 part of starch, 5 fluid parts of glycerin, and 3 fluid parts of distilled water. These jellies are used as lubricants, as bases for ointments, and in the preparation of certain suppositories. Mucilage of starch, *mucilago amyli* (Br. Ph.), is employed chiefly as a vehicle for enemata. For *iodized starch*, see under IODINE (vol. i, page 537).

STAVESACRE.—See STAPHISAGRIA.

STEAM.—The employment of the vapour of water by inhalation is treated of in the article on INHALANTS (vol. i, page 528). In cases of *acne* with decided induration of the lesions and a tendency to their appearance in successive crops, also in those of *chronic eczema* with pronounced infiltration, the daily exposure of the affected parts to the action of steam, as hot as it can comfortably be borne, continued for from fifteen minutes to half an hour, often proves of great service. Liberson (*Médecine moderne*, February 15, 1896; *Medical Record*, March 28, 1896) finds that it not only aids in the absorption of superficial and deep infiltration, but also diminishes or arrests purulent secretions, removes crusts, checks oozing, and provokes a regeneration of healthy tissues.

Steam has been employed as a *hæmostatic*. In a series of lectures, etc., published under the auspices of the Imperial University of Moscow (1894, No. 4 [summarized in the *Centralblatt für Gynäkologie* for January 19, 1895, and from that in the *University Medical Magazine* for August, 1895]), Dr. Snegirjoff advised its use for controlling *hæmorrhage* during operations, and said that for seven years he had employed it after dilatation and curetting of the uterine cavity. A small metal cannula, attached by a rubber tube to a kettle containing water at the boiling point, was introduced into the cervical canal. The steam was applied for a minute. This was always followed immediately by complete hæmostasis and was not associated with pain or other symptoms. When it was applied in *carcinoma of the uterus* the fœtid discharge and hæmorrhage disappeared, and the pain was relieved. When it was applied to the cavity of a uterus that was afterward removed the endometrium was found to be cauterized and covered with a thin white membrane, showing that the steam had acted as a *caustic hæmostatic*, *anæsthetic*, and *antiseptic*. In a series of experiments on animals, the liver was extirpated with the loss of but little blood, and the animal survived; also a portion of the spleen, lung, kidney, and brain. Hæmorrhage from bone was controlled, and a new growth of bone tissue followed the operation. A horn of the uterus of a dog was excised. Bleeding from a longitudinal or transverse incision in the femoral artery ceased after the application. Muscular and cutaneous hæmorrhage ceased immediately, and the operation was always followed by primary union. In 1893 Dr. Snegirjoff began to apply the method in a series of operations at the Alxina Hospital. In five cases of resection of the knee joint the operation was performed without the use of an Esmarch tube, hæmostatic forceps, or ligature. In amputation of the breast for cancer, and cancer, lipoma, and cavernous tumours of the skin, in amputation of the cervix uteri, and in hysterectomy for fibroid tumours, to control hæmorrhage from the stump, the application proved effective. After the incision of abscesses it was employed as a method of disinfection; in hæmorrhage from a sinus or fistula, particularly if it was tuberculous, hæmorrhage was controlled entirely.

The writer in the *University Medical Magazine* adds an abstract of a subsequent article on the subject by Dr. Ludwig Pincus, of Dantzic (*Centralblatt für Gynäkologie*, March 16, 1895). Pincus referred to Snegirjoff's publication and reported nine cases in which steam had been employed in controlling hæmorrhage from the uterine cavity and in treating *endometritis*. In a case of *carcinoma of the fundus uteri*, with severe pain in the pelvis, hæmorrhage, and fœtid discharge, the application had immediately been followed by a discharge of dark-coloured fluid containing degenerated tissue, and the hæmorrhage and fœtid discharge had disappeared and not returned until after eleven days. The treatment was continued for a minute and a half, and was not associated with any degree of pain.

Steam was used in three cases of uncomplicated *hyperplastic endometritis*, with severe *menorrhagia*. In one case three applications were made, each lasting a minute. The menstruation during the next two months was regular and normal, lasting from two to three

days. In the two other cases which he had observed but two and three weeks respectively, the hæmorrhage had not returned. About the third day after each application there had been a profuse leucorrhœal discharge, which had completely ceased between the ninth and the twelfth day. In one of these last cases the treatment had been followed by uterine colic. Five cases of *cervical endometritis* were under treatment, but had not been observed long enough for any definite results to be reported. Pincus concludes that the method is of undoubted value, particularly from a bacteriological standpoint, and that it should be of great value in *septic puerperal endometritis.*

Superheated steam has been used as a *caustic.* Dr. Panecki, of Dantzic (*Therapeutische Monatshefte*, January, 1896; *Deutsche Medizinal-Zeitung*, June 1, 1896; *New York Medical Journal*, June 20, 1896), thinks steam preferable to other caustics for destroying the diseased endometrium. The caustic action of steam at the temperature of its generation, he says, is superficial if it is used for a brief application only; if it is applied for a long time or in a superheated state (heated to 248° F.), its action extends deeper. He says the method of its application is very easy and simple, so that the physician needs no assistant; moreover, it is entirely painless, and he has never seen it do any harm.

STERCULIA.—*Sterculia* (or *Cola*) *acuminata* is a tree of the *Malvales* indigenous to western Africa and cultivated in various tropical countries. The seeds, contained in a capsule known as the *kola nut*, or *garu nut*, contain caffeine, a small amount of theobromine, a fixed oil, and a volatile oil. Kola, although not official, has of late come into use as a *tonic* and *stimulant to the nervous system.* Like coca, it is credited with marvellous sustaining powers that enable persons to endure great and protracted exertion, either bodily or mental, or deprivation of food without suffering from fatigue or hunger, also with *aphrodisiac* properties and with promoting the appetite for food. It is an efficient and acceptable substitute for tea and coffee. It seems to act as a *tonic to the heart.* It is said that by chewing from 20 to 40 grains of the fresh seeds a person may often overcome *seasickness* in about three quarters of an hour. Kola has been used in France as a remedy for *diarrhœa.* Dr. Albert L. Gihon, of the United States Navy (*Medical Times*, April 17, 1886), was among the first in this country to use kola therapeutically, in an obstinate case of *neurasthenia* which rapidly yielded to its use. It is probable that its chief virtue will be shown in such cases. There are many preparations of kola on the market, most of them proprietary. Probably the fluid extract is as satisfactory as any of the others; it may be given in doses of from 15 to 20 drops.

STERESOL.—This is an antiseptic varnish said to consist of 135 parts of shellac, 5 of benzoin, 25 of tincture of Tolu, 3 of oil of cinnamon, 50 of carbolic acid, and enough alcohol to make 500 parts. It is used topically in *diphtheria.*

STERNUTATORIES, or remedies or measures which excite sneezing, were formerly employed to stimulate the secretion of the mucous membrane of the nose, thus relieving the system of "peccant" substances, and to relieve various morbid conditions by repeated acts of sneezing. At the present time they hardly enter into medical practice and are only employed when it is desired to obtain the aid of sneezing to expel foreign bodies from the nose, and even then they may be dangerous, causing rupture of weakened blood-vessels. Snuff and black pepper are obtainable almost everywhere, and are as suitable as any other sternutatory. Occasionally it will be found that small *objects in the eye*, such as particles of sand, can be removed by causing the person to close the affected eye while sneezing is excited. The rapid passage of air through the nose undoubtedly causes a partial vacuum in the tear duct, and the consequent sudden gush of tears from the eye is very apt to wash out the foreign body. The same effect may often be produced by closing the nostril of the same side as the affected eye and blowing the nose with considerable force.

RUSSELL H. NEVINS.

STIBIUM.—See ANTIMONY.

STILLINGIA, or queen's root, is the root of *Stillingia silvatica*, an American herbaceous plant of the *Euphorbiaceæ.* In large doses, it is *emetic* and *cathartic;* in the doses ordinarily employed, it is credited by some practitioners with *alterative* virtues similar to those ascribed to sarsaparilla, and is used in the treatment of *syphilis*, *scrofula*, and other *dyscrasiæ.* The fluid extract, *extractum stillingiæ fluidum* (U. S. Ph.), may be given in doses of from 15 to 45 minims.

STIMULANTS.—These may be defined as agents whose influence is to augment the vital activity or function of an organ or to increase the vital energy of the entire system. By the heightening of the physiological functions, stimulants may, at the same time, carry a corrective or an economical effect upon systems weakened or partly disturbed by diseased conditions. Many of the substances used therapeutically as stimulant agents evoke an intensifying action upon normal tissues or systems of the human organism. With few exceptions, however, the subject will be discussed in this article from its therapeutical standpoint, such deviations being made only for the sake of lucidity.

Colloquially, the word "stimulants" is used with reference to alcoholic liquors. Aside from the fact that these agents are of undoubted use in the treatment of disease, their ancient usage demands some consideration. Wine is referred to by Homer, and evidently its increased strength acquired by age was known to the ancient Greeks, since the poet makes mention of wine eleven years old. The Brahmans used the moon-plant (*Asclepias acida*) as a sacrifice for the expiation of sin; and the faithful were not allowed to touch the sacred plant except for religious purposes. The inhabitants of Egypt were acquainted with the intoxicating powers of grape wine, and fermented wine formed a

conspicuous part in the religious services of the ancient Jews, as it does in the communion services of the present day. Every nation, savage or civilized, possesses some characteristic stimulant, from the coffee of the Javanese and the tea of the Chinese to the kumyss of the Tartars and the coca leaves of the South American Indians. Stimulants in some form seem to be essential to the carrying out of routine duties; and it is altogether likely that the stimulant required by the savage before his entrance into battle or previous to the undertaking of a journey, is identical, so far as its purpose is concerned, with the exhilarant which the man of higher civilization demands in his struggle for maintenance and advancement. Whatever may be the purpose of its ingestion, it is true that every race and tribe is possessed of some stimulant in its armamentarium of life. The moral and political sides of the question can not be discussed in this place.

Broadly, stimulants may be grouped into two great classes, *general* and *local*. By *general stimulants* are meant those agents which produce their effect simultaneously upon the entire system. Theoretically, most of the stimulant substances would come under this head, since vital energy or the increase in the vital forces is recognised chiefly from the manifestations of the circulatory and nervous apparatus. And yet a line must be drawn, for many of the agents under consideration induce their manifestations by their influence upon organs or sets of organs. Such stimulants are known as *local stimulants*, and when general effects are produced by them it is by secondary action or by the ingestion of a dose larger than is necessary to call forth the merely local influence. Again, not all stimulants possess alone a vivifying effect upon the organism or a part of it. Some of them, like opium, for instance, have in different doses a sedative influence; while others—for example, carbonate of ammonium—may produce irritation. Yet the primary effect of the stimulants is stimulation, and for the present purpose they will be so considered.

Before reviewing some of the properties of the main stimulants, it will be well to recognise the general principles underlying their use and the indications for their administration. The personal element and the individual temperament offer bases for study. A man addicted to the use of coffee, for example, will respond but poorly in emergency, as a rule, to the alkaloid of the bean. Habit plays an important rôle in the determination of the effect desired from a stimulant agent. A patient exhausted in a typhoid fever who has been a heavy user of alcohol in any of its forms will require a much larger proportion of this stimulant to secure a beneficial action than one whose system is not permeated with it. It is so well known that drunkards withstand severe disease poorly that it has become an established principle that such patients, especially when they suffer from grave injuries which shock the nervous system, shall receive copious libations of alcoholic stimulants, for without them they will most certainly succumb. The withdrawal of any accustomed stimulant evokes a shock which is often more to be feared than the impending or present disease. Exception should be made, perhaps, in the case of tobacco, for many users of the weed lose their taste for smoking or chewing during an acute disease, sometimes even permanently. The individual temperament, aside from habit, must be taken under consideration, too. Coffee or tea may make one person wakeful, and have the reverse effect upon another. Tobacco may calm one mind and distress another; it may arouse the intellect on the one hand, or may cloud and obscure its workings on the other. Alcohol in any of its forms presents the most diverse effects upon different persons. It may produce drowsiness or wakefulness; it may constipate or cause diarrhœa; it may relieve a headache or be responsible for the reverse condition; its use may cause strength in one, weakness in another; from one intellect it may call forth brilliancy and it may blunt another.

Sex has an important bearing upon the administration of stimulants. Women yield to them much more easily than men, and require, therefore, smaller doses. The aged require stimulation, particularly in diseased conditions, while children, in health at least, are independent in this respect. The habitual use of some stimulant is preferred for old people by many authors as giving tone to the stomach, brain, and heart. The effects of stimulants vary with race and climate. Savages yield readily to the influences of stimulant agents to which they are not accustomed, and, like diseases which are generally innocuous in civilization, such agents in large quantities may prove fatal. Stimulants can be used with greater freedom and less danger in their native places than elsewhere, as witness the prolonged and harmless chewing of coca leaves by travellers in South America. The effects of stimulants are modified by disease. Enormous doses of alcohol can be given in typhoid fever, for example, without bringing about intoxication, and in cases of chronic debility immense quantities of alcoholic liquors may be taken with impunity.

All agents used as stimulants depend upon some contained active principle for their effect, which is, in its turn, dependent upon the quantity administered. Within certain limits, too, they are all capable of replacing ordinary food for the sustenance of the system. In the case of alcohol this is probably due to the prevention of tissue waste by purely chemical means, since carbon and hydrogen are offered to the oxygen of the blood in place of the elements in the tissues. The coca leaves offer, on corroborated evidence, a large amount of sustenance and great powers of endurance. Coffee and tea have sustaining powers to a marked degree, and in the case of perhaps the greatest proportion of civilized nations form the chief element of the first meal of the day. Some African tribes, when preparing for long journeys, take with them only coffee and butter as articles of food.

Alcoholic stimulants may stand as a type for general stimulants. Under this head may

be included whisky, brandy, wines of all kinds, ale, beer, porter, and stout. Whisky and brandy may be regarded as representing what are known as diffusible stimulants, those which are quickly absorbed and act with corresponding rapidity. In diseases marked by the so-called *typhoid state*—that is, in *adynamic conditions*—the alcoholic medicines are pre-eminently indicated, not for any curative influence, indeed, but because their ingestion at the time when weakness is manifested in all the organs, and mental hebetude supervenes, produces a purely stimulant effect first, and secondarily acts as a food to the patient. The dose of alcoholic stimulants in such phases of disease demands, however, careful consideration. Should intoxication, even of slight degree, supervene, the succeeding exhaustion and depression are dangerous in the extreme. The amount to be given must be accurately gauged and can be determined only by experiment. By administering these stimulants in small doses the dose for each individual may be ascertained with precision and the further advantage may be gained of maintaining the stimulant action for a considerable time. The different degrees of susceptibility and their causes, as enumerated above, must be constantly in mind.

The diffusible stimulants are of value in other conditions, too, than the mere exhaustion of disease. In the beginning of the milder infections, such as an *acute coryza* or *amygdalitis*, a hot alcoholic drink, taken during or immediately after the initiatory chill or chilly feeling, may abort the attack. Persons exposed to cold and wet feel an immediate renewal of warmth after the ingestion of one of the diffusible stimulants, particularly if it is accompanied by immersion of the feet in hot water. In cases of temporary *weakness of the heart*, as in *fainting*, a warm alcoholic stimulant is of great service. In all instances of cardiac depression, whether from poisoning, shock, or hæmorrhage, alcohol is one of the best means at our disposal for stimulating the heart to act, and temporarily to bridge over the crisis. It has undoubtedly saved many lives when used subcutaneously in large doses in impending death in the instances mentioned.

Whisky and brandy, being very diffusible, are to be preferred for rapid stimulation. The heavier wines, such as port, burgundy, sherry, and claret, are of greater service in the *convalescent stages of prolonged disease;* they have a more agreeable taste and are tonic as well as stimulating. Champagne is an excellent stimulant after severe operations and tends to allay *vomiting* and *nausea* when given very cold in frequent small doses.

All the alcoholic stimulants have the same effect upon the heart's action and the cerebral areas. The stimulation by these agents is evoked by an increase in the arterial pressure and by a reflex contraction of the vessels. The heart-beat is accelerated and becomes more forcible by reason of reflex action from the sensory nerves of the mouth, œsophagus, and stomach when the fluid is taken internally. It is quite probable, too, that there ensues a local dilatation of the cerebral arteries as a consequence of the ingestion of the fluid, which accounts for the usual accompanying cerebral stimulation. The quantity and the quality of the blood sent to the brain, together with the varying contraction and dilatation of the blood-vessels and the force of the cardiac beat, also aid in giving rise to cerebral stimulation. Very small amounts of the other general stimulants, such as tea, coffee, betel nut, and the kola nut, have a rapid effect when taken by sipping. The influence is much more pronounced, and even a glass of cold water, slowly sipped, will produce a quick increase in the arterial pressure and a stimulation of the circulation. Similar results may be obtained by stimulation of the nasal mucous membrane by the odour of volatile salts, such as carbonate of ammonium. The use of smelling salts is dependent for its restorative effects upon this principle.

The *cold bath* is a highly valuable respiratory and cardiac stimulant in cases of *insolation*, and thus induces a general stimulating effect. In these instances it exerts a tonic effect, too, upon the peripheral nervous system, the brain, and the spinal cord. In *asthenic conditions* provoked by prolonged fevers or by other exhausting causes, the cold bath, judiciously employed, exerts a favourable influence by its stimulation of the vital functions. *Restlessness* is quieted, sleep may be induced, and *delirium* and *prostration* may be lessened by its use. The respiration and the circulation feel the influence of the stimulative process, the former being deepened and amplified, the latter receiving a renewal of tone. In this instance stimulation is evoked by the calming and soothing sequel of the agent. The *hot bath*, also, by its sedative action, causes stimulation of the cardiac beat in a reflex way, and thus augments the energy of the system. Its good results are seen especially in *atonic conditions of the lungs and kidneys* and in some forms of *heart disease*. The local application of water in the form of sprays and douches and sheet baths induces a general stimulant effect which is of use in many nervous states. (For the indications and methods see under HYDRIATICS.)

Dry heat, by affording a dilatation of the cutaneous and subcutaneous blood-vessels, exerts the influence of a general stimulant upon the organism. In cases of *shock*, whether or not it follows an operation, the application of hot-water bags, of heated sand, or of tin cases containing hot water to the sides and extremities of the patient aids in keeping up the balance of the circulation and in restoring the animal heat. In the *algid stage of cholera* and in *asphyxia* from immersion or from other causes, dry heat is valuable as a restorative having the subsequent effect of a general stimulant. In the treatment of all cases in which the temperature has fallen below the normal, dry heat in conjunction with two of the cardiac stimulants, atropine and digitalis, is pre-eminently indicated.

In some manner not understood, *opium* may act as a supporting and stimulant agent in some forms of *low fever* and in conditions of

adynamia from any cause. When there is *vomiting* and not enough food is retained to maintain life, opium is of service in tiding over the patient until such times as the functions are restored to the normal standard. In such cases, administered in small doses, it acts as a general stimulant, supporting the circulation, maintaining the heart and lungs, and keeping the mind clear.

Electricity must be regarded as a general stimulant when its influence in restoring vital functions after *deep narcotism* or *asphyxia* is considered. After the cessation, or apparent cessation, of respiration in chloroform anæsthesia, the faradaic current, applied to the phrenic nerve at the root of the neck, may renew respiratory movements. In *asphyxia neonatorum* and in impending *apnœa* or in *orthopnœa*, the faradaic current may evoke deeper and fuller breathing. Only in so far as electricity is of aid in stimulating the vital functions, however, can it be regarded as a general stimulant.

The *oxygen* of the inspired air is one of the main stimulants which the body receives. It is as essential, too, as it is constant in its entrance to the organism. Inhaled pure or as such, oxygen acts as a stimulant to the cardiac and vascular apparatus and produces a feeling of energy which is imparted to the entire system. The effects on the pulse are said to be transient, but the general exhilarating influence remains as long as the oxygen is administered. In *dyspnœa of cardiac or pulmonary origin*, whether the mind is clear or obscured, oxygen, given by inhalation, may help to take the place of the impaired movements of the lungs, furnishing a sufficient supply of the gas to last until the ætiological difficulty is overcome. Frequently it may arouse a patient from a light coma in the condition specified.

Strictly speaking, only alcohol in its various forms, dry heat, and electricity should be included among the general stimulants. But it is very difficult to draw a sharp dividing line between those agents which stimulate the entire system and those whose influence extends indirectly to the entire organism through their action upon the cerebro-spinal axis and the vascular apparatus. Among these may be mentioned coca, coffee and caffeine, tea and thebaine, tobacco and nicotine, chocolate, wines of all kinds, ammonia and many of the salts of ammonium, ether and chloroform, and camphor. Many of these are cardiac stimulants and are referred to under CARDIAC STIMULANTS.

It is of value in cases of *general debility*, in *depressed conditions* of the *spinal cord*, and in *functional weakness* of some of the *internal organs* to administer *spinal stimulants*. Where an inflammatory condition of the motor centres of the cord exists, however, spinal stimulants are apt to do more harm than good. Little benefit can be expected from the use of these agents in paralyses of organic origin, but when a hemiplegia depends upon a toxic effect, as in *lead poisoning*, they are of a specially useful nature. The excellent results obtained from their administration in *nocturnal enuresis*, in *atonic retention of urine*, and in *loss of voluntary motion in groups of muscles* are well known. When prolonged overwork or great excitement has caused *mental and physical depression*, some of the spinal stimulants are serviceable. All the spinal stimulants probably act by increasing the excitability of the nerve cells in the spinal cord and thereby increasing the rate at which stimuli, particularly reflex impulses, are transmitted. Their influence, like that of the general stimulants, extends to the heart and circulation and in some part to the brain. The most prominent of the spinal stimulants is strychnine, and it may stand as a characteristic type of the group as alcohol does for the general stimulants. Thebaine and brucine are next in their power of action, and others, of less importance, are absinthe, ammonia, gelsemine, calabarine, and nicotine. In very large doses, also, opium, morphine, and atropine may call forth convulsions of spinal origin, so that in this sense they might be called spinal stimulants.

One of the most important groups of medicines in all departments of therapeutics is the class known as cardiac stimulants. Their use is essential and is indicated in many conditions of acute and chronic disease. In the treatment of *shock* from any cause, where there is weakness in the cardiac beat or depression of the cardiac ganglia or muscle, cardiac stimulants are indicated. In the prolonged course of an acute disease, infectious or not, where *asthenia* or *adynamia* supervenes, the cardiac stimulants are of use to support the patient or to carry him over a crisis. *Profound collapse* with depression of the circulation and respiration, instances of *threatened death from suffocation* or *drowning*, and the *shock from an anæsthetic* offer legitimate opportunities for the administration of stimulants for the heart. In the crises of *pneumonia*, when the right heart is working against tremendous odds, it is doubtful if we could dispense with the cardiac stimulants. *Exhaustion* from any cause, whether from disease or from overwork, from great excitement or from prolonged emotional strain, demands the efficient and intelligent use of the medicines under consideration.

There are two conditions, broadly speaking, which call for the use of cardiac stimulants. The first is *convalescence from disease* in which the heart, like other organs, has become depressed and weakened, and added to this indication might legitimately be appended certain forms of heart disease in which the viscus is not properly fulfilling its function, and the *weakness of old age*. The second indication is, to generalize, any sudden failure of the cardiac apparatus or any group of symptoms pointing to an impending cessation of the heart's beat. The symptoms are so plain and so easy to be recognised that it is not necessary in this place to rehearse them. Suffice it to say that it does not matter what the ætiology of the heart's poor action may be, the use of stimulants in the conditions enumerated is urgently demanded. The cardiac stimulants properly included in the first group mentioned should, strictly speaking, come under the head of cardiac ton-

ics, although their influence is first a stimulant, later a tonic one. They will therefore not be discussed here. (See under CARDIAC TONICS, vol. i, page 217.) The stimulants of the second group, however, come legitimately into this article.

Alcohol stands foremost as a rapid and safe cardiac stimulant. In those instances in which it is used to prevent or to counteract *sudden failure of the heart*, it must be given in concentrated form. Its most diffusible preparations are whisky and brandy; and to perform their work most quickly these should be administered subcutaneously. In cases in which the patient can not swallow the medicine, the alcoholic preparation may be given in the form of an enema; but it is apt to be expelled from the rectum, for an unconscious or partly comatose patient has little or no control over his sphincter muscles. In an emergency, alcohol is best given in small doses frequently repeated, since its stimulant action is thus longer maintained. Its effect should be carefully noted, too, for it is apt to prove harmful rather than beneficial if it does not succeed in bringing the pulse nearer the normal standard in force and frequency. Moreover, it is clinically well established that large doses of alcohol may paralyze the cardiac muscle, and in some cases even a temporary reduction of the power of the heart may prove fatal. In combination with alcohol, *ether* forms one of the most reliable of heart stimulants, although its good effects in an emergency are as often obtained when it is used alone or with camphor. Ether must be given subcutaneously when it is given for its stimulant effect; or, rather, the injection must be made deep into the tissues. It is very prone to produce an abscess at the site of injection, but even this sequel would hardly be a formidable objection in the face of impending death. The field for which ether is particularly adapted is that of the unexpected *cardiac failure* sometimes seen in *chloroform anæsthesia* or even in *ether narcosis*. In Germany and Austria it is chiefly depended upon as a cardiac stimulant, to the almost utter exclusion of other similar agents. In flagging of the heart evoked by a large or uncontrollable hæmorrhage, neither ether nor alcohol can be substituted for an *intravenous* or *intra-arterial saline infusion*, than which there is no better stimulant for the heart. Particularly when the infusion is combined with the use of strychnine is its effect upon the cardiac apparatus a strikingly stimulant one. A saline solution thrown into the rectum, if of the physiological strength, may accomplish beneficial results for the heart in instances of shock or hæmorrhage. Even the injection of the same solution into the intercellular spaces, as in *cases of suffocation* from illuminating gas, evokes a powerful cardiac stimulation. (See under TRANSFUSION.)

Ammonia has long been recognised as an efficient cardiac stimulant in *collapse* and in *intoxications with cardiac depression*. It may be thrown directly into a vein, or its vapour may be applied to the nasal mucous membrane, or it may be given subcutaneously, alone or in combination with an alcoholic preparation. Ammonia, like alcohol, is reflex in its action on the cardiac apparatus, and accomplishes its stimulation not only by its influence upon the heart, but by its effect upon the vaso-motor centres also. The best preparation of ammonia for this purpose is the *aqua ammoniæ fortior* (U. S. Ph.), or the *liquor ammoniæ* (Br. Ph.).

Among the alkaloids which may be used in sudden cardiac failure, with results which vary, are *atropine*, *strychnine*, *digitaline*, and *caffeine*. Of these, strychnine gives the greatest tone to the heart, while the others render its beat more efficient. The *nitrites* are excellent cardiac stimulants. While one is waiting for an effect from subcutaneous instillations, inhalations of *nitrite of amyl* will prove helpful in rousing a heart on the verge of collapse or failure. *Nitroglycerin*, hypodermically administered, acts like nitrite of amyl in producing a lessening of arterial pressure with increase in the force and frequency of the pulse.

Among agents not drugs which may be regarded as reliable cardiac stimulants, *heat*, dry or moist, occupies a prominent position. A poultice or hot-water bag, placed over the heart, may be serviceable in time of emergency. The use of large quantities of hot water by the rectum or by the mouth will prove beneficial to the heart in *hæmorrhage* especially. The impression upon a flagging or collapsed heart of *counter-irritation*, particularly the frequently repeated (sixty to seventy times a minute) pressure of the thumb over the præcordia, is to awaken its muscles and ganglia to renewed efforts, and it may be satisfactorily employed in *sudden cessation of the beat of the heart during anæsthesia*. Some of the volatile oils also have a reputation as cardiac stimulants.

Stimulation of a heart suddenly weakened demands, above all, rapidity. Hence the method of evoking the stimulation should be, preferably, by subcutaneous or intravenous injection; next, the rectum is to be chosen; and lastly, the mouth.

Vascular stimulants, although closely related in their action to cardiac stimulants, are useful in preventing the congestion of internal organs by equalizing the visceral and peripheral circulations. After exposure to cold and wet, for instance, a chill may be aborted and the subsequent congestion prevented by the use of a hot alcoholic drink combined with pediluvia. All agents which dilate the peripheral vessels may be regarded as vascular stimulants when they increase the vigour of the circulation in these vessels simultaneously. Such agents are the *nitrites*, *ether*, *alcohol*, *dry or moist heat*, and to a less degree *ammonia*.

Stimulating expectorants are agents which increase the tone of bronchial mucous membranes which are over-secreting, and by so doing diminish the amount and improve the character of the expectorated material. Some of these act by increasing the blood-pressure, others by a direct action upon the mucous membrane. In this group should be included *chloride of ammonium*, the *mineral acids*, *strychnine*, *benzoin*, the *balsams*, *licorice*, *senega*, *terebene*, and others of less importance.

When the low pressure under which bile is secreted is interfered with, causing an absorption of the biliary fluid or its partial suspension of secretion, *hepatic stimulants* are indicated. The condition of "biliousness" is so well known, even to the laity, that its description is not needed here. The agents most frequently called into requisition to remedy this state are the *mercurial* and *saline cathartics*, the *mineral acids*, and some of the *vegetable cathartics*. The mere ingestion of food of the proper kind is frequently sufficient to call forth an abundant flow of bile.

The *stimulant diuretics* have distinct indications. When there is an accumulation of serous fluid in the tissues or cavities of the body, when the blood contains harmful toxic or metabolic products, or when the urine becomes too concentrated, these agents are valuable. If the excess of fluid is due to cardiac disease, *digitalis* and *strophanthus*, by their diuretic action, are of value. If the dropsy is dependent upon renal or hepatic influences, *squill*, *uva ursi*, *buchu*, or the *potassium salts* may be added. In *febrile conditions*, in which the solid elements of the urine are usually deficient and their retention is naturally harmful, the stimulant diuretics foster their elimination. For this purpose, and to increase the blandness of the renal secretion, the *potassium salts*, *turpentine*, *caffeine*, and *juniper* may be administered. The *venous congestion of mitral and tricuspid disease* and of *chronic bronchitis* may be relieved by the influence of digitalis upon diuresis. For the details as to all the agents used as stimulants, reference should be made to the separate articles on those agents.—SAMUEL M. BRICKNER.

STŒCHAS.—See LAVANDULA.

STOMACHICS.—By some authors stomachics are held to include all remedies that promote digestion, such as the digestive ferments, etc., but generally the name is restricted to the aromatics and bitters (*q. v.*).

STORAX, *styrax* (U. S. Ph.), *styrax præparatus* (Br. Ph.), *styrax liquidus* (Ger. Ph.), *balsamum styracis*, liquid storax, is a balsam extracted from the inner bark of *Liquidambar orientale* (seu *imberbe*).

The tree from which storax is obtained resembles in appearance the maple or plane tree, is bushy, medium-sized, with smooth, lobed, stipulate leaves, and smooth, purplish-gray bark. It is indigenous to southwestern districts of Asia Minor, where it forms forests. Its range is a limited one, not extending to the north or to the islands of the Levant.

The balsam is expressed from the inner bark which is scraped off with a sickle-shaped knife after the outer bark has been removed. The inner bark thus obtained is boiled in water from the sea, by which means a portion of the resinous matter is melted out and is skimmed off as it rises to the surface of the liquid. The boiled bark is next subjected to pressure in haircloth bags, with the addition of hot water, and a still further portion of the resin is obtained. The storax thus extracted is a soft, resinous compound, of honey-like consistence, and has a peculiar, balsamic, agreeable odour, and a pungent, burning taste. It is of a grayish-brown colour and contains a considerable amount of water, to which its opacity is due. The water separates after long standing or on heating, leaving a heavier, yellowish-brown substance which is more or less transparent. With age it improves in odour and hardens, though it always remains sticky. When pure, storax dissolves in alcohol, in ether, in chloroform, and in most of the volatile oils. Storax is purified by melting and straining or by dissolving in rectified spirit, filtering, and evaporating the solvent.

Among the more important constituents of storax are the hydrocarbon *styrol*, or *cinnamine*, C_8H_8, a thin, colourless liquid of fragrant odour; *storesin*, $C_{30}H_{38}O_{31}$, an amorphous substance; *cinnamic acid;* and *styracin*, or *cinnamate of cinnamyl*, $C_9H_7O_2C_9H_9$, a crystallizable substance with an agreeable hyacinthine odour. When styracin in alcohol solution is treated with soda it is converted into cinnamate of sodium and *cinnamalcohol*, which latter is also known as *styryl alcohol*, or *styrone*, $C_9H_{10}O$, and is said to be an *antiseptic* and *deodorizer*. As found in the shops, storax is often adulterated with turpentine.

As an internal remedy, storax is now but little used except as a constituent of the compound tincture of benzoin. It has been recommended, however, as a substitute for copaiba, which it closely resembles in its action. It is said to be a useful *expectorant* in *bronchial troubles*, and has been highly spoken of as a remedy in *diphtheria* and in *pseudo-membranous croup*. In *gonorrhœa* and also in *leucorrhœa* it has been said to be equally efficacious with copaiba and less disagreeable to take. The dose is from 10 to 20 grains, two or three times a day.

Storax is chiefly employed as an external remedy, and more especially in the treatment of *scabies*. Its effects are very similar to those of balsam of Peru, than which, however, it is said to be somewhat less efficacious. The two drugs may with some advantage be combined. They are both especially suited to cases in which the skin is tender, as in children, or is much inflamed and such strong remedies as sulphur, naphthol, and the like are too severe. The storax is usually applied in the form of a salve made with lard or vaseline or as a liniment made with olive oil. Unna used it with rape-seed oil as in the following formula:

℞ Storax, Rape-seed oil, each ..... 10 parts;
Alcohol..... 1 part.
M.

The storax may be rubbed in pure or mixed with a small proportion of oil. It is but slightly irritating to the skin, and there is little or no danger from its absorption into the economy. Unna reported nine cases of albuminous urine out of 124 cases of scabies treated with storax inunctions, but it is not improbable, as has been intimated, that the precipitate thrown down by heat and nitric acid in these nine cases, which was taken for albumin, may have

been only a resinous deposit. The test of its solubility in alcohol was apparently not tried. In the treatment of scabies the inunctions should be preceded by a soap bath, after which the skin is allowed to become thoroughly dry before rubbing in the storax or its oily solution. In simple cases two inunctions will usually suffice to effect a cure, and seldom are more than four necessary—one in the morning and one at night, for two days.

Liquid storax is said to be a useful application in *frostbites* attended with ulceration.

EDWARD BENNET BRONSON.

STRAMONIUM.—The leaves and seeds of *Datura stramonium*, or the thorn-apple, are both official. The official leaves, *stramonii folia* (U. S. Ph.), *folia stramonii* (Ger. Ph.), are the dried leaves of the plant. They have a heavy, strong narcotic odour and an unpleasant, bitter, nauseous taste. The dried ripe seeds, *stramonii semen* (U. S. Ph.), *stramonii semina* (Br. Ph.), are bitter in taste and of an unpleasant odour when crushed. The leaves contain a small quantity and the seeds a large quantity of *daturine*, an alkaloid quite identical with atropine. In the seeds there is also some *hyoscyamine*.

There is very little difference in action between stramonium and belladonna. The chief use of stramonium is as an *antispasmodic* in *convulsive coughs* and in *asthma*. It has been used as an anodyne in a few painful affections. In asthma it is taken by inhalation of the fumes of the burning leaves or ignited powder. Cigarettes are made of stramonium for the use of asthmatic patients. A very good mixture for igniting and inhaling is one of 1 drachm of nitrate of potassium, ½ drachm of chlorate of potassium, 1 drachm of stramonium, and 20 grains of ipecac. The leaves of *Datura tatula* have been employed as a substitute for those of *Datura stramonium*, the former plant containing the same alkaloid as the latter.

[The dose of the powdered leaves is from 1 to 3 grains; that of the extract of the seeds, *extractum stramonii seminis* (U. S. Ph.), *extractum stramonii* (Br. Ph.), is from ¼ to ½ a grain; that of the tincture, *tinctura stramonii seminis* (U. S. Ph.), *tinctura stramonii* (Br. Ph.), is from 10 to 30 minims; and that of the fluid extract, *extractum stramonii seminis fluidum* (U. S. Ph.), is 1 minim. Stramonium ointment, *unguentum stramonii* (U. S. Ph.), is serviceable as a mild *anodyne* application in *itching* and *burning affections of the skin*, in *painful hæmorrhoids*, in *boils*, in *irritable ulcers*, etc.]—FREDERICK PETERSON.

STREPTOCOCCUS SERUM.—See under SERUM TREATMENT.

STRONTIUM.—Three of the compounds of strontium, the bromide, *strontii bromidum*, the iodide, *strontii iodidum*, and the lactate, *strontii lactas*, are official in the U. S. Ph.

Strontium bromide and **strontium iodide** are used for the same purposes as the corresponding salts of potassium, sodium, and ammonium: in addition, the bromide has been observed to have a decided effect in reducing the amount of sugar lost in the urine in *diabetes*, and Dr. Carselli, of Palermo, has found it remarkably efficient in *acute gastritis* in doses of 10 grains three times a day, with or after the meals. It is said to stop the vomiting and lessen the pain, which it accomplishes not only by a direct action on the nervous system, but also by acting as an *antiseptic*, thus arresting fermentation and reducing *flatulence*.

Mr. Anthony Roche (*Lancet*, September 26, 1896) thinks strontium bromide rather superior to the other bromides in the treatment of *epilepsy*. He has used it, alone or in combination with other bromides, in four cases. The patients were not cured, but they obtained much relief. In all the cases other bromides had been employed before, and the addition of the strontium salt seemed to be more beneficial. It has long been noticed, he says, that a combination of bromides acts more favourably than any one of them alone. It should be impressed upon the patient that he must take the medicine for a long period, whether it has at first a beneficial effect or not. Mr. Roche thinks the bromide of strontium well entitled to further trial. The treatment adopted by him, besides meeting any general indications, obtaining the best hygienic surroundings possible, and advising a strictly vegetable diet with milk, is to give 20 grains of the bromide of strontium with from 5 to 10 grains of the bromide of ammonium or sodium night and morning, largely diluted with water. The dose of strontium is rapidly increased to a drachm twice a day if the smaller doses do not control the attacks, and if the patient does not complain of it. The majority of his patients, he says, took the strontium without any depression, but generally with the production of an acne rash on the face. Liquor arsenicalis added to the mixture controlled the rash and increased the appetite. This course in all the cases materially lessened the number of the attacks. The ordinary dose of the bromide is from 3 to 10 grains; that of the iodide is from 5 to 10 grains.

Strontium carbonate has been recommended by Métral (*Bulletin général de thérapeutique*, October 30, 1895; *Medical News*, November 30, 1895) as a *dentifrice*. He gives the following formula for a tooth powder:

℞ Strontium carbonate, Flowers of sulphur, of each ½ oz.;
Essence of rose..... 6 drops.
M.

Strontium lactate has been used as an *intestinal antiseptic* and for the purpose of diminishing *albuminuria* in *parenchymatous nephritis*.

Brouowski (*Wiener medicinische Presse*, September 13, 1896; *British Medical Journal*, November 7, 1896) gives a preliminary account of the results of his clinical and experimental investigations into its action upon the kidneys. His first experiments were upon rabbits, and consisted in the daily subcutaneous injection of a quantity equal to double the dose in proportion to the animal's weight. After a month one rabbit had gained 7 oz. in

weight, and the second 10 oz., while the third had not altered. They were perfectly well in every way, and after they had been killed the internal organs were found to be normal. The drug was then tried in ten cases of kidney disease, three of which were *acute parenchymatous nephritis*, six *mixed nephritis*, and one *interstitial nephritis*. Six doses of 15 grains were given daily, and well borne. In all cases the volume of the urine increased, and its specific gravity fell. This effect began on the second or third day, was most marked on the sixth or seventh, and persisted two or three days after the use of the drug had been discontinued. The action was most decided in acute cases, and was much slighter in the chronic forms; the albumin diminished *pari passu* with the increase in the urine. In acute cases it disappeared entirely, but in chronic cases no diminution was observed. The ethereal sulphates in the urine, by which the amount of intestinal putrefaction may be estimated, were unaffected, and there was no constant change in the pulse or blood-pressure. The antiseptic properties of lactate of strontium were tested upon a patient with an intestinal fistula in the cæcal region, and found to be extremely slight. The author concludes that strontium lactate is a pure diuretic, and is more valuable than any other remedy in the treatment of acute inflammatory conditions of the kidney.

Strontium lactate has also been found to aid the digestion in cases of *dyspepsia due to an excess of hydrochloric acid in the gastric juice*. It is essential that it should be pure and free from barium oxide. The dose is from 5 to 10 grains.

Strontium phosphate has been recommended as a tonic in place of calcium phosphate, in doses of from 10 to 30 grains.

Strontium salicylate, according to Dr. Horatio C. Wood, of Philadelphia (*University Medical Magazine*, January, 1895), tends less to lower the arterial pressure than either sodium or ammonium salicylate. He has accordingly employed it in a large number of cases in amounts ranging from 15 to 120 grains a day. The result of these trials shows that in doses of from 5 to 10 grains, given after meals, the salt very commonly improves digestion, and the dose of 5 grains an hour after meals, in *flatulent dyspepsia* and in various conditions of tendency to fermentative changes in the alimentary canal, is a useful *intestinal antiseptic*, one that has seemed to give better results than salol, naphthol, or any of the older intestinal antiseptic remedies. Dr. Wood says that it does not give rise to cinchonism so readily as the older salicylates, but may produce it in a pronounced degree. He has not tested it in acute articular rheumatism, but thinks it would be less efficacious than the ammonium salicylate. In *muscular* or *subacute rheumatism*, as well as in *chronic gouty conditions* with a tendency to digestive disturbance, Dr. Wood has found it to be a very valuable remedy, exerting the action of the salicylate upon the diathesis, and improving instead of injuring the digestion. It may be given in solution, but it is best administered in capsules; a 5-grain capsule is of moderate size, and of these two or more may be taken at once. The taste of this salt is similar to that of the ordinary salicylates, but distinctly less offensive, so that, if it is preferred, it may be given in a weak solution.

Strontium and caffeine sulphonate.—See SYMPHORAL.

STROPHANTHIDIN, STROPHANTHIN.—See under STROPHANTHUS.

STROPHANTHUS (U. S. Ph.), *semen strophanthi* (Ger. Ph.), is derived from the seeds of *Strophanthus hispidus*, a tropical climbing apocynaceous plant. Its main habitat is Africa, where it grows more abundantly in the heart of the continent than along the coast. A preparation of the seeds of the plant, known as *iné* or *kombé*, is used by the natives as an arrow poison, producing death by muscular paralysis. The seeds have little or no odour, but an exceedingly bitter taste. The U. S. Ph. recommends this test for the purity of the seed, and it is of some importance since several varieties appear in commerce: "A decoction of 1 part of the seed to 10 parts of water is of a brownish colour and is not changed on the addition of a solution of iodine, of ferric chloride, or of potassium mercuric iodide."

In 1877 Gallois and Hardy isolated from the seeds a principle, probably a glucoside, which they called *strophanthin*. It appears as white shining crystals; but it is likely that this is a decomposition product, since Fraser, on more careful analysis, separated a glucosidal principle with different properties which he termed *strophanthidin*. This active principle of the seeds is imperfectly crystalline, is neutral in reaction, and has a very bitter taste. It is freely soluble in water, less soluble in alcohol, and insoluble in ether and in chloroform.

The physiological action of strophanthus and its active principle have been studied by a number of observers, but unanimity of conclusion has not been established in all particulars. Upon the lower grades of animals, *iné* or *kombé* caused, in toxic doses, a tonic contraction of the heart terminating in an arrest of the beat, with death by syncope accompanied by nausea and vomiting. The isolated heart of the amphibian is as susceptible to the drug as the organ of the uninjured animal. When the drug is brought into immediate contact with muscular tissue it acts at once as a muscular poison, and its influence is as marked and as immediate whether the muscle belongs to the striated or to the unstriated variety. A peculiar effect upon muscular tissue wrought by the drug is that the increase of tone which appears as its primary influence does not diminish; but on the death of a muscle passes at once into a state of post-mortem rigidity. Since the reaction of the muscular tissue is, at the same time, acid, it would appear as if this state were due to the rapid development of myosin. The paralysis evoked by the contact of the poison with voluntary muscular tissue probably extends also to the cardiac and respiratory muscles when it causes death.

Observers are not agreed as to the influence of strophanthus upon the circulation. The statement made by one experimenter that it increases the blood-pressure is as promptly denied by the next one. The bulk of evidence, however, seems to be in favour of the proposition, and it is likely that the augmented blood-pressure is caused by the action of the drug upon the muscular walls of the arteries, like that which it exerts upon the heart muscle.

The question of the *diuretic* value of strophanthus is as unsettled as that of its influence upon the circulation. Some writers have asserted that in *ascites* especially the drug produces marked diuresis; others contend that this influence appears only when there is obstruction to the circulation in the heart. Csatáry (review in the *Centralblatt für die gesammten Therapie*, vol. v, 1887), after careful experimentation, affirms that in a perfectly healthy condition there is no diuretic action on the part of strophanthus. He finds that the toxic influence of the drug on the heart increases the force and frequency of the cardiac beat, and says this is the influence which evokes an elimination of fluids from the body. Further, he states, the normal or diseased condition of the kidneys plays no rôle in this diuresis. Cases have been reported of dropsy dependent upon cardiac disease with congestion of the kidneys and lungs which have been relieved by the administration of strophanthus.

A fall in the number of beats of the heart is a usual result of the administration of strophanthus. The decrease depends upon the dose. Five drops of the tincture are said to have caused a fall of from eight to twelve beats a minute; twenty drops, a fall of thirty beats. In *pneumonia* the temperature is said to fall, sometimes one degree, with the decrease in the pulse-rate; but the respirations seem not to be similarly affected.

The effect of strophanthus is quicker than that of digitalis, but is more evanescent. It seems to have no cumulative action, or very little. Its influence lasts for three or four hours, occasionally longer, when the dose must be repeated to secure a further effect. Despite the fact that its cumulative action is so rare, the tincture has produced poisonous symptoms. In one reported case in which the drug was used for some cardiac disease, cyanosis and dyspnœa with pronounced cardiac distress appeared and collapse followed. There was no pallor or vomiting, however, as in digitalis poisoning. Evans (*Medical News*, June 16, 1888) reports the case of a child who took 20 drops of the tincture. The face became flushed, the skin was dry and hot, and the pupils contracted and dilated alternately at very short intervals. The pulse-rate was 140, the radial pulse was full, and the heart-beat was vigorous. The sensorium was undisturbed. Urinary suppression for ten hours followed. Recovery ensued.

The conclusions to be derived from a study of the writings on strophanthus may be summed up as follows: The drug, however administered, invigorates the heart muscle while dilating the cardiac cavities. The walls of the arteries are also dilated and the arterial, but not the venous, pressure is probably increased by its use. The frequency of the heart beat and, naturally, of the pulse is reduced; the force of the heart is probably also diminished. A secondary effect is the regulation of the heart's rhythm. The drug is probably diuretic, but not cumulative. Sometimes its use occasions nausea, vomiting, and diarrhœa.

From a consideration of its physiological action, the indications for the use of strophanthus will be seen to correspond to those which call for the administration of digitalis. It may be given to tone the cardiac muscle in *obstructive* or *degenerative valvular lesions of the heart* when compensation is lacking or has not been fully established. It is especially useful in disease, more particularly in *stenosis, of the mitral valve* without degeneration of the cardiac muscular fibre. Fraser, who has studied the drug more carefully than any one else, has asserted that the hæmostatic power of strophanthus is much inferior to that of digitalis, and that its value in valvular disease of the heart depends upon the soundness of the muscular tissue of that organ. When the heart muscle is impaired, he says, strophanthus affords no more relief to the weakly-acting or overworked organ than digitalis. In any case of *cardiac weakness* strophanthus may be given with safety and its effect looked for in from half an hour to an hour. In cases of *shock* with impaired heart action, or in *collapse* or *threatened syncope*, it is a valuable drug. Given subcutaneously, the tincture is very irritating to the tissues, but its effect is rapid—more rapid than that of digitalis—and in an emergency it may be so used, even if an abscess subsequently appears. It must not be forgotten that its influence does not last so long as that of digitalis, and when it is depended upon for cardiac stimulation, its employment must be repeated. By some clinicians strophanthus is regarded as an excellent adjuvant to digitalis, although as a substitute for the latter it is not in high favour. It may replace digitalis, however, in those cases of excited heart action in which digitalis fails to evoke a sedative action, or when digitalis has been used for a long time without producing its usual effect upon the heart muscle. Digitalis causes a diminution in the arterial tension as well as in the pulse-rate; strophanthus is capable of calling forth the latter phenomenon only. Strophanthus, because it does not constrict the arteries while re-enforcing the energy of the cardiac beat, is useful in cases of *cardiac dropsy* when there is simultaneous *congestion of the kidneys* and *lungs* or of either. In irregular or insufficient heart action leading to *œdema of the lungs* the drug may be given subcutaneously or by mouth with a decidedly good effect. Its diuretic action has caused its use with alleged good results in the treatment of *renal calculi*. In many forms of *low fever* with weak heart action strophanthus has been recommended. It has been praised as well in the treatment of *pneumonia, pulmonary tuberculosis, asthma*, and *hemiplegic conditions*. In the *uræmia* of Bright's disease and the *cardiac dyspnœa* attending the train of symptoms

in the same disease, strophanthus is a valuable remedy. By its producing diuresis it aids in the elimination of the metabolic products circulating in the blood, and by its restoration of energy to the heart muscle it frequently succeeds in effectively relieving the dyspnœa.

Strophanthus is alleged to have the power of aborting the so-called *urethral chill* consequent upon the passage of a sound; but in this respect it is probably inferior to quinine. After the administration of strophanthus *malarial chills* are said to be less rigorous, and nervous chills are alleged to lose much of their force.

Because of its exceedingly bitter taste strophanthus has the effect of a *simple bitter* when taken in small doses. Since it has no cumulative action, its pronounced influence upon the heart need not be feared when it is given for this purpose; but there are so many drugs superior as stomachics to the one under consideration, that this tonic influence must be regarded as purely secondary; it would not be well to give a medicine so intense in its action for purely stomachic effect. The tincture of strophanthus has been recorded as having cured a case of *urticaria*, but the "cure" was probably a coincidence.

Success has been alleged for the drug in the treatment of *exophthalmic goître*. For this purpose the tincture is given in doses of 2 drops every six hours, and the dose is gradually increased to 10 drops. The good results reported are supposed to emanate from the sedation of the cardiac action. Though one can not deny the reliability of these reports, since cases have been recorded in America and Austria, it would seem that the relief of the heart's tumultuous action was regarded as a sign of cure.

Children seem to be able to take strophanthus in proper doses with no untoward effect, and some clinicians have preferred it to digitalis when either was indicated. The toxic action of strophanthus is much more rapidly evolved than that of digitalis, however, and caution must be observed when it is administered to children. One must be prepared to combat poisonous symptoms, as evidenced by cold sweating and nausea, by appropriate symptomatic, stimulant treatment.

The dose of the tincture, *tinctura strophanthi* (U. S. Ph., Ger. Ph.), is, for an adult, from 5 to 8 drops three or four times daily. For a child the dose is 1 drop thrice daily. The tincture is best given diluted or flavoured with some syrup, since the ingestion of the pure tincture is apt to provoke irritation of the mucous membrane of the mouth, œsophagus, or stomach. It is well to begin with the minimum dose unless one is acquainted with the preparation, for it may be impure or of too great strength. When it is desired to obtain a very rapid effect of the drug, the tincture may be given hypodermically, although, as has been mentioned already, it may cause an abscess when so administered. There is an unofficial *extract of strophanthus*.

Strophanthin has been so little experimented with that great caution should be exercised in its administration. It seems difficult to obtain it chemically pure, and the dose has been variously given as from $\frac{1}{300}$ to $\frac{1}{16}$ of a grain. Given hypodermically, strophanthin is a powerful irritant locally, too irritating to be safely given in depressed conditions. When it is administered by the mouth it seems to produce the same physiological effects as strophanthus, one part to six million having caused systolic cardiac arrest in a frog. Locally applied, strophanthin is a more powerful *anæsthetic* than cocaine. Three or four drops of a solution of one to one thousand instilled into the eye will produce complete anæsthesia of the ocular and palpebral conjunctivæ that will last for several hours. The sensations of heat and cold are the last to disappear and the first to return. Although the glucoside does not appear to affect the conjunctivæ unfavourably, it is apt to cause a cloudiness or even an ulcer of the cornea, probably by a hyperæmia induced by its irritant action. This, naturally, unfits it for the production of ocular anæsthesia. Peterson (*Medical Record*, January 31, 1891) has recommended the administration of strophanthin percutaneously by means of cataphoresis. For this purpose he uses the anode next the skin, moistened in a solution of strophanthin or a tissue-paper disc containing $\frac{1}{250}$ of a grain of the glucoside, with a current of from 5 to 8 milliampères. No irritant action is evoked by this method of using the drug.

[Dr. W. K. Wadleigh, of Hopkinton, New Hampshire (*Medical News*, March 14, 1896), has found that among the aged strophanthus gives much better results in almost every condition than other remedies of its class. In old age, he says, we often find an atheromatous condition of the arteries, and, although digitalis may not be positively contra-indicated, in all such cases it is very apt to do little good, and sometimes may even do harm. The *vertigo* of aged people, caused by *cerebral anæmia*, or by a lack of balance between the different parts of the circulation of the brain, is a condition in which he has been able to do much good with strophanthus. His experience leads him to believe that strophanthus will produce benefit in a larger number of cases of *angina pectoris* than any other single remedy. In general *anæmia* and *chlorosis*, when accompanied by weakness of the heart, it not only gives great relief so far as the heart symptoms are concerned, but, by sending more blood to the tissues, increases their nutrition. It is often an advantage to combine it with nitroglycerin in anæmia. In the so-called *irritable heart*, characterized by palpitation on slight exertion, more or less pain in the region of the heart, often quite severe, and a weak, quick pulse, sometimes intermitting, but with no organic disease of the heart present, says Dr. Wadleigh, we may give strophanthus with almost an absolute certainty of benefit from its use, and it will often cure the patients.]

SAMUEL M. BRICKNER.

STRYCHNINE.—See under NUX VOMICA.

STUPES are cloths, sponges, or the like, dipped into some fluid and wrung out to prevent dripping, and applied to some portion of

the body. They are usually employed hot and for the relief of *pain*, to abort inflammatory processes, and in all conditions when poultices would be indicated, but are inconvenient to apply. Flannel is the most convenient fabric that can be used, and it may be of any shape that is most suitable for the part on which it is to be used. It should be dipped in as hot water as can be had, wrung out so as not to drip, and applied immediately, care being taken that it is not hot enough to burn sensitive parts. It should then be covered with a dry towel or cloth, and oiled silk or rubber cloth should be put over the whole. To prevent scalding of the hands in wringing out, the flannel may be placed in a towel, the two ends of which are to be twisted in opposite directions. When practicable, a hot-water bag should be placed next the flannel, so that the heat may be retained longer and the frequent renewal of the stupe avoided, which is the most serious objection to its employment. For the relief of all *neuralgias of the head* and *face* there is probably no simple measure which is so effectual. In all conditions such as *colic*, *peritonitis*, etc., when abdominal pain is severe, relief will usually be afforded, especially if a few drops of oil of turpentine are sprinkled upon the flannel immediately before its application, but it is not to be used in too large amounts, as it may be absorbed and strangury result. Spirit of camphor may be substituted for the turpentine, and with benefit in many instances, for it will set up more or less irritation of the skin, as the plain water will if its use is continued for any length of time. Laudanum also is useful, and in acute affections of the air-passages may relieve the strong inclination to *cough*, especially when the stupes are applied over the front of the neck. A few grains of red pepper may be dusted on the flannel with the view of acting as a counter-irritant. Chloroform or ether will act as counter-irritants and also have a slight local anæsthetic action. Stupes of plain hot water may be useful to allay the pain of *sprains*, *bruises*, etc. They should not be employed in acute affections of the chest, as it is necessary to renew them frequently, and the exposure attendant upon their removal should be avoided. For some hours after their use there may be a slight erythema of the skin.

RUSSELL H. NEVINS.

STYPTICIN.—This is the trade name of cotarnine hydrochloride, $C_{12}H_{13}NO_3.H_2O.HCl$. Chemically, says Dr. S. Gottschalk, of Berlin (*Therapeutische Monatshefte*, December, 1895; *Therapeutische Wochenschrift*, December 22, 1895), cotarnine, which in combination with opianic acid forms the narcotine found in opium, is very closely related to hydrastinine. Cotarnine hydrochloride is comparatively non-poisonous and a very efficient *hæmostatic* in gynæcological practice. It is described as an amorphous powder, almost of a sulphur-yellow colour, readily soluble in water, forming a solution which becomes cloudy on exposure to light.

Dr. Gottschalk has given the drug by the mouth in doses ranging up to ½ of a grain five or six times a day. Subcutaneously, he has employed a sterilized 10-per-cent. watery solution, and in cases of profuse metrorrhagia injected 3 grains (30 drops of the solution) deep into the gluteal muscles once a day. With a few patients who did not bear opium well, the drug appeared to act as a *sedative* and *analgetic*, so that it was found particularly serviceable in cases in which, together with *uterine hæmorrhage*, there was *dysmenorrhœa*. In this respect Gottschalk finds cotarnine superior to ergot and hydrastis, and he finds it also a suitable drug for protracted use. Cotarnine, he says, acts promptly in hæmorrhages due purely to *uterine subinvolution*; if, however, there are remnants of the ovum retained in the uterus, ergot and its preparations, in conjunction with hot irrigations, work better. He recommends cotarnine in hæmorrhages due to *fungous endometritis*, especially if they are of ovarian origin, but only as a palliative. In *hæmorrhages due to fibroids* and in those associated with *the climacteric* cotarnine is of service, but in those that are secondary to parametric exudations it is inferior to hydrastis and hydrastinine. In purely *congestive menorrhagia*, not dependent on organic disease, he has met with good results from the concurrent use of cotarnine and hydrastis or hydrastinine. The remedy is powerless against hæmorrhages that depend on the presence of polypous growths in the uterine cavity, no matter how small they may be. Cotarnine is contra-indicated in cases of threatened abortion, also in uterine hæmorrhages occurring in the course of pregnancy. It has not yet been definitively ascertained whether cotarnine acts on the walls of the blood-vessels or on the muscular tissue of the uterus. In cases of menorrhagia Dr. Gottschalk thinks the hæmostatic effect of cotarnine is rendered more certain by giving it for four or five days before the flow is expected, but in reduced doses (not more than 0·035 of a grain), four times a day. As soon as the flow begins the doses are to be doubled. At the height of a profuse menstrual flow as much as 3 grains may be injected into the gluteal muscles, and this may be repeated for several successive days without any unpleasant result. For internal use, it is best to order cotarnine in pills or in gelatin capsules. When given by the mouth it acts more slowly than when injected into the tissues.

STYPTICS.—See HÆMOSTATICS.

STYRACOL.—This is the cinnamic ether of guaiacol, $C_6H_4(OCH_3)\diagdown\!\!\diagup O$ / $C_6H_4.CH:CH.CO$, a crystalline body. It is a powerful *antiseptic* and has been employed to some extent internally in gonorrhœa and in gastro-intestinal catarrh, but its use can not be recommended until further reports of its action are published.

STYRAX.—See STORAX.

STYRONE.—This is a compound of storax and Peruvian balsam, a yellow, oily, aromatic liquid. Its agreeable odour commends it as an *antiseptic* and *deodorizer*. Dr. James A. Spald-

ing, of Portland, Maine (*Archives of Otology*, xx, 3), recommends its use particularly in cases of *perforation of Shrapnell's membrane*. Largely diluted with alcohol, so that the solution contains from 1 to 5 per cent. of styrone, it may be used for syringing the auditory meatus. It reduces the amount of the discharge and overcomes its odour.

SUCCINIC ACID, $C_4H_6O_4$, is a colourless crystalline substance obtained by the distillation of amber. Ammonium succinate has been used in medicine (see vol. i, page 58).

SUCCINUM.—See AMBER.

SUCROL.—See DULCIN.

SUDORIFICS.—See DIAPHORETICS.

SUET.—Mutton suet, *sevum* (U. S. Ph.), *sevum præparatum* (Br. Ph.), purified and rendered almost odourless by melting and straining, is employed as a bland application (see FATS and TALLOW).

SUGAR.—The carbohydrates are organic compounds containing in the molecule six or a multiple of six atoms of carbon and about twice as many of hydrogen. They are divided into three general groups: saccharoses ($C_{12}H_{22}O_{11}$), glucoses ($C_6H_{12}O_6$), and amyloses ($C_6H_{10}O_5$). These groups are closely allied chemically, the first and third being readily converted into the second. They occur very widely distributed throughout the vegetable kingdom. The term sugar is applied to the saccharoses and glucoses, and in a more restricted sense to the saccharoses alone.

The sugars have a more or less sweet taste and are very soluble in water. Chemically, they exhibit the properties of polyatomic alcohols. Sugars, with one or two exceptions, possess the power of rotating the plane of polarized light. When this plane is rotated to the right they are known as dextrorotatory, and are represented by the mark +. When the plane is rotated to the left they are known as lævorotatory, and are represented by the mark —. The saccharoses all belong to the first class. Of the glucoses, diastase and galactose are dextrorotatory; levulose and sorgose are lævorotatory. Each element has a specific rotatory power peculiar to itself which is measured in degrees. By taking advantage of these properties very accurate methods of quantitative analysis have been devised.

Saccharoses.—The chief saccharoses are saccharose, lactose, and maltose.

Saccharose, *saccharum* (U. S. Ph., Ger. Ph.), *saccharum purificatum* (Br. Ph.), or cane sugar, $C_{12}H_{22}O_{11}$, is the substance to which the term sugar is most commonly applied. It is found in the juices of most sweet fruits, in honey, in the nectar of flowers, and in the juices of many plants. It is derived chiefly from the sugar cane (*Saccharum officinarum*), from sorghum (*Sorgho saccharatum*), from beet-root (*Beta vulgaris*), and from the red maple (*Acer saccharinum*). The juice of the sugar cane is obtained by expressing it from the stalk. By a somewhat intricate process, the crystallizable portions are removed. These, being refined, form the ordinary sugar of commerce. A brown liquid containing the uncrystallizable portions is left. This is known as molasses, treacle, or syrup. Cane sugar crystallizes in large transparent, double oblique prisms. It is soluble in half its weight of cold water, in one fifth of its weight of boiling water, and in 175 parts of alcohol, but is not soluble in ether. It melts at 220° F. If heated above this point it loses its water, becomes dark in colour, and forms a brown amorphous substance of a slightly bitter taste known as caramel. Strong sulphuric acid chars sugar and leaves a blackened mass. Dilute nitric acid oxidizes it into oxalic acid. Sugar forms a number of metallic compounds known as saccharates. By fermentative action sugar yields carbon dioxide and alcohol. In the open air sugar keeps indefinitely, and for long periods of time in concentrated solutions. It is readily decomposed, however, in dilute solution by the action of several fungi, the yeast plant being the most common. It may also undergo acetic, lactic, and butyric fermentation on the addition of specific germs.

Sugar has very slight medicinal properties, but is largely used in pharmacy, chiefly in the form of syrups. Simple syrup, *syrupus* (U. S. Ph., Br. Ph.), is a 65-per-cent. solution of sugar in distilled water. The numerous medicinal syrups are made either directly from sugar or from simple syrup. They are used for a double purpose—to form a palatable vehicle and to preserve drugs in solution. Sugar enters largely into the composition of the various elixirs, a few tinctures, and some other preparations. It is an important element in troches. It is largely used in cough syrups, and is believed to have some effect in relieving cough. Honey, *mel*, is sometimes used for the same purposes as syrup. It contains a certain amount of glucose.

As an article of food, sugar is used in enormous and steadily increasing quantities. It is largely used in the preservation of fruits and some other forms of food. Its excessive use is the cause of much indigestion and dyspepsia, particularly among children and young adults, as it is prone to undergo acid fermentation in the stomach. In the presence of sour milk it undergoes lactic fermentation with extreme rapidity. The addition of it to an infant's food may therefore do much to render any tendency to indigestion difficult of control. In diabetes it is necessary to prohibit its use entirely, although it is not the form of sugar which is found in the urine of these patients.

[Sugar, either dry or in concentrated solution, may be used as an *antiseptic* application to *wounds*, *ulcers*, etc., in an emergency, when more energetic agents are not at hand.

Sugar has been employed as an *oxytocic*. Dr. Bossi, whose account of his experience with it is summarized in the *Revue internationale de bibliographie médicale, pharmaceutique et vétérinaire* for April 25, 1894, found that it answered the purpose well and was free from the inconveniences attending the action of ergot. In eleven cases of *uterine inertia* during labour an ounce of sugar dissolved in water was given, and in ten of them it had a most

favourable effect on the pains. The ecbolic action of sugar is said to be apparent in from twenty-five to forty-five minutes, and in many cases to be sufficiently prolonged to accomplish the expulsion of the child. In some of Dr. Bossi's cases it was found necessary to give a second dose of the same amount, an hour after the first one, in order to terminate the labour. The contractions excited by sugar are described as always perfectly regular, never taking on a tetanic character. (See under OXYTOCICS.)]

Lactose, saccharum lactis, sugar of milk, $C_{12}H_{22}O_{11}.H_2O$, is the saccharose obtained from whey. It is used largely in pharmacy and for the feeding of infants. For a more complete description see SUGAR OF MILK.

Maltose, malt sugar, $C_{12}H_{22}O_{11}.H_2O$, is formed by the action of the diastase of malt upon starch. It is the chief product resulting from the action of saliva and pancreatic juice upon glycogen and starch paste. It is soluble in water and in alcohol, but crystallizes with difficulty in fine needles. For a further description of maltose, see under MALT.

Glucoses.—The chief glucoses are dextrose, levulose, inosite, galactose, and sorbinose.

Dextrose, or *grape sugar*, $C_6H_{12}O_6$, usually passes under the name of glucose. It is widely diffused throughout the vegetable kingdom, and is found in the greatest amount in grapes, sprouting grains, honey, and sweet fruits. It is often found in the liver and blood of mammalia, in the yolk of eggs, and in the urine of diabetics. It may be produced artificially by acting upon starch with dilute sulphuric acid. It is thus manufactured in enormous quantities. Corn starch is chiefly used for this purpose. It is boiled with dilute sulphuric acid, then rendered neutral with lime, and the resulting liquid is drawn off and evaporated down to a syrup, which is allowed to crystallize. It crystallizes, however, with more difficulty than cane sugar does, and does not usually present the same crystalline appearance. It has much less sweetening power than cane sugar has, the proportion being as one to two and a half. Glucose readily forms compounds with many metallic salts, especially oxides, and is therefore considerably used as a reagent. It undergoes alcoholic fermentation with the greatest readiness, and is largely used in beer-making as a substitute for maltose.

Glucose has no medicinal properties. Its value as an article of food is not wholly settled, but it is not regarded by the best authorities as entirely wholesome. It is believed that it may, if used in large quantities, predispose to diabetes. It is largely sold under the name of sugar, but fraudulently, as its sweetening power is far less than that of cane sugar, and in wholesomeness it is far inferior. It enters largely into the composition of molasses and syrups designed for food purposes, and is used in very large quantities in making candy.

Levulose is closely allied to glucose. It differs from it chiefly in being less fermentable, in its rotatory power, and in a few minor points. Its sweetening power, however, is less than that of glucose. When pure it is easily assimilated.

Inosite is a rare compound which has been found in small amounts in the muscles and in diabetic urine.

Galactose resembles glucose very closely, but ferments less easily and has greater rotatory power.

Sorbinose is a very sweet soluble sugar found in mountain-ash berries.

FLOYD M. CRANDALL.

SUGAR OF MILK, *saccharum lactis* (U. S. Ph., Br. Ph., Ger. Ph.), or *lactose*, $C_{12}H_{22}O_{11}.H_2O$, is the peculiar sugar derived from milk. It occurs in white, four-sided prisms, has a sweetish taste and gritty feel, and is soluble in seven parts of cold water. It is insoluble in alcohol, in ether, and in chloroform. The sugar of milk of commerce is obtained chiefly from cow's milk by evaporating whey and crystallizing out the sugar. Cow's milk, according to the extensive observations of Leeds, contains from 3·5 to 5·5 per cent. of lactose, the average being 4·42 per cent. The lactose of cow's milk is usually stated as 4·5 per cent. The lactose of woman's milk, according to Leeds, varies from 5·4 to 7·9 per cent., the average being 7 per cent. The lactose of the two milks is identical chemically, physiologically, and physically. The carbohydrates in the food of adults are represented by starches and the various forms of sugar. In milk they consist of lactose alone. Lactose in its chemical properties is intermediate between cane sugar and starch. It occurs in larger quantity than any of the other solid constituents of human milk, forming more than half the total solids. As it is readily soluble, it is easily assimilated and requires but little expenditure of energy to effect its transformation preparatory to digestion. In this it differs materially from starch. This is clearly a wise provision of Nature, as the infant can not maintain its animal heat by locomotion.

Milk sugar readily undergoes lactic-acid fermentation, at least ten varieties of bacteria being known to produce that result. Butyric fermentation also takes place quite readily. It does not, however, ferment readily under the action of yeast.

Until recently it was difficult to obtain perfectly pure sugar of milk, but the largely increased use of it has resulted in improvements in the method of its manufacture. It can now be obtained practically pure and occurs as a perfectly white, transparent, crystalline powder. Its extreme hardness renders it admirably adapted for use in the trituration of drugs. It is now used for that purpose in the manufacture of Dover's powder and in nearly all triturations as well as the tablet triturates. In the manufacture of these tablets the medicinal agent is triturated with sugar of milk until a thorough and complete division and complete distribution of it have been made. The resulting powder is then made into a paste with varying proportions of alcohol and water or other menstruum and afterward moulded into tablets. This method of administering medicine has become very popular during recent years. The medi-

cinal agent is thoroughly triturated and equally divided, with a consequent perfect accuracy of dose. Most of the tablets containing drugs dissolve readily and are elegant in appearance. Sugar of milk is also considerably employed in the feeding of infants. It is almost universally regarded by pædiatric specialists as more satisfactory for this purpose than cane sugar. For further information see MILK, section on *Infant feeding* (vol. 1, page 633).

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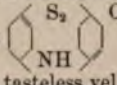
SUGGESTION.—See under HYPNOTISM.

SULPHAMINOL is a thioxydiphenylamine prepared by E. Merck by boiling metoxydiphenylamine with soda and sulphur, filtering, and precipitating with ammonium chloride. Its formula is given as



It is an odourless and tasteless yellow powder, insoluble in water, but readily soluble in alkalies and less readily in their carbonates. Sulphaminol is an *antiseptic* and is used chiefly as a substitute for iodoform in the topical treatment of *wounds, suppurating surfaces, tuberculous deposits*, etc. It is unirritating and non-poisonous. Taken into the system, it splits up into sulphur and phenol. It has been used internally in cystitis in doses of 3½ grains, four times a day.

Sulphaminol-creosote, an 8-per-cent. solution of sulphaminol in creosote, is used topically for the same purposes as sulphaminol. So also are *sulphaminol-eucalyptol, sulphaminol-guaiacol*, and *sulphaminol-menthol*. "*Sulphaminol salicylate*," a mixture of 8 parts of sulphaminol and 92 of salicylic acid, is employed topically like sulphaminol and given internally, in doses of from 3 to 6 grains, in *rheumatism*.

SULPHANILIC ACID.—The sulphanilic acid used in medicine is one of three isomeric compounds of aniline made by heating aniline with fuming sulphuric acid. It forms tabular, prismatic, or laminar crystals which are almost insoluble in cold water, in alcohol, or in ether, but more readily soluble in hot water. Ehrlich has proposed the use of sulphanilic acid as a urinary test and also as a remedy for *iodism*. It may be given in daily amounts of 90 grains, associated with sodium bicarbonate to facilitate its solution in water.

SULPHATES.—See under SULPHURIC ACID.

SULPHIDES.—See under SULPHUR.

SULPHINIDE.—See SACCHARIN.

SULPHITES.—See under SULPHUROUS ACID.

SULPHOCARBOL.—See ASEPTOL.

SULPHOCARBOLATES, or salts of sulphocarbolic acid, a combination of equal weights of carbolic acid and strong sulphuric acid, are assumed to possess nearly all the medicinal properties of carbolic acid, but to exert less marked constitutional effects than the acid. Sulphocarbolates of calcium, magnesium, potassium, zinc, and sodium, *sodii sulphocarbolas* (U. S. Ph., Br. Ph.), are found in the shops. With the exception of the last named, they are almost always used in solutions of varying strength as local applications in *diphtheria*, the *sore throat of scarlet fever, amygdalitis, gonorrhœa*, and all conditions in which an astringent and feeble antiseptic is indicated. They are sometimes employed in vaginal douches in the puerperal state, and with good results. The zinc salt is probably the most useful in any of the conditions mentioned, as it has the greatest astringent power.

The sodium salt is employed internally, in doses of from 10 to 30 grains, in *flatulent dyspepsia*, in the *vomiting of pregnancy*, and whenever there appear to be fermentative changes in the alimentary canal, but, as a rule, it has not proved of great value.

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SULPHOCYANATES.—Martinotte (*Riforma medica*, February 13, 1896; *British Medical Journal*, April 11, 1896) has experimented with potassium sulphocyanate as a remedy for *pulmonary tuberculosis*, but definite results have not yet been reported.

SULPHONAL, *sulfonalum* (Ger. Ph.), or *dional*, is a synthetical product which was brought into notice in Germany in 1886 by Baumann, and now appears in the market as a semi-proprietary preparation. It is obtained by the interaction of anhydrous mercaptan and anhydrous acetone in the presence of a stream of dry hydrochloric-acid gas. The liquid becomes turbid and separates into two layers, the upper one of which is mercaptol. This is separated, washed, and oxidized by means of permanganate of potassium into sulphonal, or, in chemical language, diethylsulphondimethylmethane, $(CH_3)_2C(SO_2C_2.H_5)_2$. It may also be obtained by combining the chloride or the bromide of ethyl with sodium thiosulphate, treating the product with water to make ethyl mercaptan, which in the presence of alcoholic hydrochloric-acid solution and acetone is condensed to mercaptol, which is oxidized as before. It occurs in heavy colourless, prismatic crystals, odourless and nearly or quite tasteless. Regarding its solubility in cold water, there appears to be considerable discrepancy of opinion, as various writers state that it may be dissolved in proportions from one to fifty to one to four hundred and fifty. It is certain that it is not very soluble in cold water, but dissolves freely in hot water and also in alcohol. It is a very stable body, not affected by concentrated acids, alkalies, or oxidizing agents either in the cold or when warm.

The physiological action of sulphonal is by no means perfectly understood. It would seem chiefly, if not wholly, to affect the cerebral centres, and a large number of the symptoms produced—such as somnolence, stupor, disinclination to mental or physical effort, muscular weakness, inco-ordination and paresis, diplopia, aphasia, and slow and weak respiration and pulse—may perhaps be explained by the theory that the irritability of the central nervous system is obtunded by its action.

But this alone does not seem competent to explain other symptoms, such as the depression of reflex activity, disorders of the digestive tract, and eruptions on the skin. Dr. Schick, of Easton, Pennsylvania, has investigated the physiological action of sulphonal by means of experiments on frogs and rabbits, and his conclusions may be quoted as the best data, on the whole, in our possession at the present time. He found that moderate doses produced relaxation of the muscles and a staggering gait, but did not affect the irritability of the motor or sensory nerve-fibres. Reflex activity was usually depressed, but was sometimes exalted. In large doses it depressed the respiration, and this depression was not affected by section of the pneumogastric nerve. When it was introduced into the system through the stomach very little if any effect was produced on the circulation, and spectroscopic examination failed to reveal any change in the blood, but when it was injected directly into the circulation it caused a slight decrease, soon followed by an increase in the arterial tension. Possibly this may be explained by the fact that when it is introduced into the stomach it acts very slowly because of its insolubility or of its slow absorption, but when it is given subcutaneously in a warm solution its effect appears much more promptly.

The method of the elimination of sulphonal from the system cannot be said to have been satisfactorily determined. It has been said by some writers to be excreted in the form of combined or uncombined sulphuric acid, and it has been said that a certain amount of unchanged sulphonal could be found in the urine. The theory latest advanced by Smith, of London, based upon experiments made on dogs, is that in its passage through the system sulphonal is broken up in such a way as to yield ethylsulphonic acid, and that this is eliminated in the urine. The same experimenter found that moderate doses increased the amount of urea and the quantity of urine excreted, but to so slight a degree that it does not appear that in such doses the destruction of nitrogenous tissue is materially affected. The phosphates in the urine are said by some observers to be increased by small and decreased by large doses of this drug. The colour of the urine is apt to be changed to a reddish brown by the presence of a colouring material which is closely allied to and has generally been supposed to be identical with hæmatoporphyrin. By almost every test the two are identical, but an examination with the spectroscope reveals a difference. It is not certain whether this substance is present in the blood or is formed during or after the process of excretion. Other pigments also are usually present in the urine.

The effect of sulphonal upon the blood-corpuscles is uncertain. Some observers say that they are reduced in number during the use of the drug, but others assert that this is an error. An occasional annoying result of its use is the occurrence of a rash on the skin, of pruritus, or of both combined.

In the report of the therapeutic committee appointed by the British Medical Association to investigate the utility of various hypnotics, the disagreeable after-effects of sulphonal are thus summarized: "In six out of ten cases in which 20 grains had been given disagreeable after-effects were noted; drowsiness next day was noted six times, giddiness four times, and headache and inco-ordination of gait each twice. In four cases where 10 grains had been given drowsiness was noted once; in five cases with 15 grains drowsiness was noted twice and giddiness twice; with 25 grains (four cases) drowsiness was noted twice, giddiness once, and headache once. In seven cases with 30 to 60 grains drowsiness was noted four times, giddiness twice, incoordination of gait and vomiting each once." Many other reports corroborate the frequent appearance of these symptoms, which may be termed mildly toxic, and it would seem as if a consideration of these and of the physiological action of sulphonal would cause the physician to exercise great care and discretion in its use, at least until the accumulated evidence of professional experience had demonstrated its action to be without danger. But such has not been the case. It has been loudly praised and highly vaunted as an absolutely safe hypnotic, and is still advertised as such, although there are numerous cases of death on record, some as the results of moderate doses. The most striking of these, perhaps, is reported by Pettit. A woman, twenty-eight years of age, who was suffering from melancholia with hysterical manifestations, but was not known to have any organic lesion, was given 30 grains of sulphonal in two equal doses an hour and a quarter apart. She slept for twelve hours and then could be roused and could swallow, but somnolence increased for the next twelve hours. The pupils began to contract eighteen hours after the last dose. At the end of forty hours the temperature began to rise, and the patient died in spite of active treatment such as is usually instituted in cases of narcotic poisoning. Rehm reports a case in which the patient narrowly escaped death as the result of the administration of 18 grains for three successive days. The usual symptoms of poisoning appeared and finally resulted in a state of collapse marked by pallor, speech reduced so as to be hardly audible, a weak and rather rapid pulse, suppression of urine, hyperæsthesia, diplopia, meiosis, and inability to move. After the lapse of two weeks the patient could walk with difficulty. A very serious feature in most of the fatal cases of poisoning is that usually the patients have been under treatment for some time and have been apparently benefited by the drug up to the time of the appearance of the toxic symptoms. Such cases demonstrate that the drug is not so harmless as it has been alleged to be, even though it is not what one writer asserts—the most dangerous of the hypnotics.

The symptoms of poisoning are numerous and of varying degrees of severity, and may possibly be explained as due to the action of the drug upon the nervous centres which maintain a controlling influence over the parts of the

body affected. They may be thus enumerated though all are not usually present in one case: Drowsiness, stupor, muscular inco-ordination, incapacity for mental or physical exertion, tinnitus aurium, headache, vertigo, partial loss of the reflexes, nausea, vomiting, constipation, sometimes diarrhœa, ataxic nervous troubles, diplopia, muscular tremor or paresis, ptosis, œdema of the eyelids, slow and weak (possibly stertorous) respiration, slow pulse, elevation of temperature, general anæsthesia, urine changed in colour to reddish brown, diminished in quantity or suppressed, aphasia, and cyanosis. Death results from cessation of respiration. In several fatal cases motor paralysis appeared to be the most prominent symptom. Recovery is usually rapid in the non-fatal cases of poisoning, if the patient is thoroughly purged and the changes in the urine disappear after two or three days.

There is no agreement in the observations made after death from sulphonal poisoning as to the lesion produced by the drug. In several cases the kidneys have been pronounced normal. Stern found extensive necrosis of the epithelium of the convoluted tubules and of the ascending limbs of Henle's loops, together with minute hæmorrhages in the kidneys due to toxic nephritis. Helweg found the cells of the anterior and posterior horns of the spinal cord degenerated and their number diminished.

[Schulz (*Neurologisches Centralblatt*, October, 1896; *British Medical Journal*, November 28, 1896) records a fatal case of chronic sulphonal poisoning. The patient, a woman, aged fifty-nine, had been under treatment some years for headaches, constipation, and restlessness, and was extremely hysterical. On account of sleeplessness she had recently been taking sulphonal in doses of 15 grains, and had taken altogether about half an ounce within a month. When she was admitted into a hospital for obstinate constipation with vomiting there was a smell of acetone in the breath, the tongue was dry and furred, and there was great thirst, with restlessness and insomnia. All the organs otherwise were normal; the urine was normal. The next evening 25 grains of sulphonal were given, and on the following day the urine was scanty and brownish-red, but free from albumin. Four days later the gait was unsteady, and five days after this there were weakness of the limbs and anæsthesia of the legs down to the ankles; the knee-jerks, previously normal, were now difficult to obtain. Weakness increased, the knee-jerks disappeared, incontinence of urine and fæces occurred, and two days later the patient died suddenly. The urine, after the single dose of sulphonal mentioned, had continued brownish-red with no albumin, but contained a few altered red blood-corpuscles. The colour was found to be due to hæmatoporphyrin. Schulz considers that the toxic results after only one dose of sulphonal were due to the obstinate constipation present, causing the sulphonal to be retained in the body longer than usual. Great caution, he says, should therefore be exercised in ordering sulphonal for patients who are constipated, and where it is ordered a careful watch should be kept of the urine for hæmatoporphyrin.

Mr. F. P. Hearder (*Lancet*, November 14, 1896; *New York Medical Journal*, December 5, 1896) reports the case of a man, forty-three years of age, who, four months previously to his admission, on May 2, 1896, into the Wakefield Asylum, had hurt the back of his head in an accident; he had suffered much from shock, and had been very nervous afterward. Three weeks before his admission he had cut his throat. On his admission the pupils were unequal, the right being more dilated than the left, which reacted more perfectly. His knee-jerks were exaggerated, and there was slight ankle clonus. His superficial arteries were thickened and tortuous; the heart's action was irritable and irregular, and the sounds were accentuated, but there was no bruit. In the urine there was a copious mucous cloud; it was acid, of the specific gravity of 1·022, and contained no albumin or sugar. His mental state was that of agitated or motor melancholia. He had a dejected and lacrymose expression, and he had aural and visual hallucinations and delusions that harm (murder, etc.) was happening to his mother and sister; he cried and prayed for their safety. During the next few days he continued restless and sleepless, needed forcible feeding, was constantly attempting to tear the bandage off his throat, and required continual supervision. A mixture of potassium bromide with chloral hydrate was given with no good effect. Sulphonal was then tried (15 grains three times a day), administered in a warm drink, apparently with very good effect, as he took his food better, slept well at night, and was less restless during the day. On the fourth day his gait was ataxic and his expression and movements were like those of a drunken man. On the sixth day the urine was noticed to be becoming scanty and high-coloured. The use of sulphonal was at once stopped and the urine examined. It contained no blood and no albumin. On the following day there was marked oliguria, about 5 ounces of urine having been passed in the twenty-four hours. The urine was of about the colour of porter which had been shaken; there was no deposit, it was acid, and of the specific gravity of 1·015. The amount of albumin was exceedingly copious, the urine, on being boiled, becoming almost solid. The patient was in a somewhat soporose state; there was slight œdema of the eyelids, but no swelling of the legs and ankles. The pulse was quiet and the temperature about normal. He was kept recumbent, a saline purge was administered, and a diuretic mixture containing citrate of potassium and acetate of potassium was given, with diluent drinks, milk and soda-water, and barley-water. On the following day the urine was still somewhat scanty, high-coloured, acid, and of the specific gravity of 1·020, but it contained no blood or albumin. The patient was better and took food (fluid and semifluid) freely. After that he made considerable physical and mental improvement, but continued depressed. Sev-

eral subsequent examinations of his urine revealed nothing abnormal.]

Observers disagree in regard to the effects produced by suddenly stopping the use of the drug after it has been employed for a considerable length of time. Some assert that no ill effects are thereby produced, while others ascribe to its sudden withdrawal a condition which resembles that produced by the abrupt withdrawal of morphine in morphinism, marked by general weakness, digestive and motor disturbances, and vertigo.

Sulphonal is slow in its action and is without doubt cumulative in the system. Hence when it is given daily for some time there is danger that it may cause toxic symptoms. This should be guarded against as far as possible by care that the bowels are kept open and that the kidneys act normally and efficiently during its administration, as well as by its prompt discontinuance on the appearance of anorexia, nausea, gastric pain, or other disagreeable or toxic symptom.

It is mainly employed as a *hypnotic*, and its use appears to be particularly indicated in cases of *mental excitement* or *distress*, over which it seems to exercise a distinct sedative action. Thus, in *acute mania*, *melancholia*, and *delirium tremens*, as well as in the milder forms of *nervous insomnia*, it induces sleep by night and quiet by day, a condition certainly conducive to the restoration of the mental equilibrium. It is not an anodyne and does not relieve sleeplessness caused by pain.

It has been used to relieve the paroxysms of *asthma*, *hiccough*, *convulsions due to teething*, and *trismus neonatorum*. Good results are said to have been obtained from its use as an adjuvant to other treatment in cases of *chorea* and *epilepsy*. On account of the relaxation of the muscles which is induced as one of its physiological effects, it has been found efficient to arrest *spasm of the muscles of broken limbs* and to relieve *muscular cramps*. It is one of the numerous remedies recommended as a means of prophylaxis against *seasickness* and the similar affection sometimes called "*train-sickness*."

In *phthisis pulmonalis*, 8 grains of sulphonal are said to be quite as competent as atropine to prevent *night sweats* equally and to exert this effect for a longer time. In *diabetes* it has been found to cause a diminution of the amount of sugar present in the urine, but to produce no permanent improvement, as the sugar increases to its former amount immediately upon the withdrawal of the drug. Its use in *typhoid fever*, *chronic opium poisoning*, and *nocturnal enuresis* has not been sufficiently extensive to warrant the expression of any conclusion.

Bad results have been reported from its use in angina pectoris, and it is now considered to be contra-indicated in this disease.

It is difficult to determine the proper dose, not only because this differs with different persons, but also because it may vary at different times with the same person, so that the amount which at one time produced quiet, sound sleep from which the patient awoke refreshed may at another time be followed by unpleasant after-effects, or the expected soporific effect may be replaced by mental excitement, headache, and other nervous symptoms, or there may simply be a failure on the part of the drug to produce any hypnotic or other apparent effect. In any given case the amount to be given must be determined by the judgment of the attending physician, but the average dose may be stated as from 15 to 30 grains once a day or every alternate day. As a rule, men require larger amounts than women.

Sulphonal is best administered in hot liquids about two hours before it is desired that the patient shall sleep. A good plan is to dissolve it in boiling water and to give it as soon as it has cooled sufficiently to be potable, flavoured if wished with a liqueur or cordial. Or it may be given in hot broth, milk, or coffee, and, as it is practically tasteless, it can thus be administered without the knowledge of the patient. In some cases it may be advantageously combined with small doses of codeine or morphine. (See also under HYPNOTICS [vol. i, page 509]).—MATTHIAS LANCKTON FOSTER.

SULPHOSALICYLIC ACID, or *salicyl-sulphuric acid*, $C_6H_3(SO_3H)(OH)COOH$, is prepared, according to Professor Coblentz, by the action of fuming sulphuric on salicylic acid, and forms white crystals which are soluble in water and in alcohol. It is said to have been employed in the treatment of *rheumatism*.

SULPHOTUMENOLIC ACID. — See TUMENOL.

SULPHUR is a non-metallic element. It has an atomic weight of 31·98 and is variously bivalent, quadrivalent, and sexvalent. As it occurs in nature, it forms yellow, transparent, rhombic crystals. It is insoluble in water, slightly soluble in alcohol and in ether, but dissolves freely in carbon disulphide, in oil of turpentine, and in benzene. It gives forth a peculiar odour when rubbed and has a very faint taste. In nature it is found free and in combination with metals in the form of the sulphides in many ores, especially copper and iron pyrites. It is very widely distributed, although its most frequent occurrence is in volcanic districts. Sulphur forms one of the constituents of the volatile oils of garlic and mustard and is found in albumins and other proteids. It is found in the Western United States, in Mexico, and in the West Indies, but the chief commercial supply comes from Italy and Sicily. Sulphur is popularly known as brimstone.

The sulphur of commerce is obtained from the native ore by the action of heat, the sulphur becoming volatilized. When this vapour is condensed, the sulphur is deposited as a fine, greenish-yellow powder with a slight characteristic alliaceous odour and a faintly acid taste from the presence of a trace of sulphurous acid. The sulphurous acid is formed by a slight oxidation of the sulphur. This form of sulphur is known as sublimed sulphur, *sulphur sublimatum* (U. S. Ph., Br. Ph.), *sulfur sublimatum* (Ger. Ph.), or flowers of sulphur. It is slightly soluble in oils and in fats, com-

pletely soluble in carbon disulphide, and insoluble in water. When ignited, it burns with a blue flame with the formation of sulphurous-acid gas, and should leave no ash.

Washed sulphur, *sulphur lotum* (U. S. Ph.), *sulfur depuratum* (Ger. Ph.), is obtained by digesting the flowers of sulphur with dilute ammonia, washing thoroughly, and gently drying and passing through a strainer. Its characteristics are those of sulphur, but it is inodorous. The U. S. Ph. directs that on the addition of water blue litmus paper must not be reddened by washed sulphur.

Precipitated sulphur, *sulphur præcipitatum* (U. S. Ph., Br. Ph.), *sulfur præcipitatum* (Ger. Ph.), is also known as *lac sulphuris*, or *milk of sulphur*. It is obtained by boiling sulphur with slaked lime and water, by which process calcium sulphide and calcium hyposulphite are formed. The addition of hydrochloric acid decomposes the salts, and the sulphur is precipitated in a fine powder. To be official, this sulphur must be washed until it is tasteless, must be free from acid, and must give no reaction with oxalic acid for carbonate of calcium and water. Because of its extreme fineness, precipitated sulphur is white instead of yellow. Its other properties are like those of sulphur.

The *antiseptic* and *antizymotic* action of sulphur has been known for a long time. Applied locally in powder, it has the power of destroying fungi and other vegetable parasites on man and the lower animals. When ignited, it gives off dense fumes of sulphurous-acid gas which are known for their bactericidal action. The fumes of sulphur dioxide destroy the germs of *cholera*, *typhoid fever*, *diphtheria*, *glanders*, and *tuberculosis*. The disinfecting qualities of the gas evolved by the burning of sulphur have been recognised by sanitary authorities, and it is the common practice to disinfect rooms that have been occupied by patients suffering from infectious or contagious disease by this means. The laboratory experiments of Squibb and those of Dubief and Bruhl (cited in *New York Medical Journal*, August 17, 1889) force one to the conclusion that the destructive action of gaseous sulphurous acid, SO_2, depends upon the moisture in the air aside from its own manifest bactericidal properties. Prolonged action of the pure gas may destroy germs even in a dry condition, according to these observers. To provide the desirable moisture in the air, a small kettle or vessel may be filled with water and heated previous to the disinfecting process, and the articles of furniture and the walls may be moistened with water or some disinfecting solution. All apertures into the room should be closed to prevent the escape of pungent gas; if necessary, the frames of the windows and doors may be stuffed with rags or cotton. Not less than 3 pounds of sulphur to each 1,000 feet of space must be burned. The powdered sulphur or fragments of the element should be laid in a pan which rests on a support in a tub of water to prevent fire. In order to hasten the combustion of the sulphur it may be moistened with alcohol. This is the method in vogue with the board of health of New York city, and it seems to meet every requirement after the occupancy of a room by a patient sick with an infectious disease. Ships which have carried passengers suffering from cholera, yellow fever, or typhus fever may be disinfected in the same way. Koch and Sternberg have shown that the spores of the anthrax bacillus are not killed by fumigation with sulphur, and that it can not be used successfully for the disinfection of clothing or bales of rags, because the gas is lost by diffusion.

Taken internally in doses of from 20 to 40 grains, sulphur produces soft stools. The flatus, after such a dose, smells strongly of sulphuretted hydrogen, H_2S. If the dose is repeated several times at short intervals, the odour of sulphur is given off by the breath and by the skin. Silver articles worn next the body are blackened, and the linen worn by the patient becomes yellow. Sulphur has also been found in the urine and milk after its administration. As sulphur is a constituent element of all albuminous bodies, it seems to be necessary to the animal economy for physiological purposes. Taurocholic acid contains the element, and it is believed that sulphur stimulates the bile-producing function of the liver.

Poisonous effects have been observed from the ingestion and from the external use of sulphur. These symptoms have manifested themselves in nausea, dysentery, tonic contractions of the muscles of the extremities, the appearance of fever, and painful urination. In one case there were extreme prostration, a sulphurous breath, clammy perspiration, vomiting and purging, and intestinal colic. Sulphur applied as an ointment is easily absorbed from the skin, and its possible poisonous action must be guarded against.

Internally, sulphur may be given as a *simple laxative* in doses of from 30 to 60 grains. It is especially valuable after pelvic or abdominal operations, because of its depleting yet gentle action. On account of the soft stools it produces, it is useful also in piles. To conceal its taste, which is disagreeable to some patients, it may be administered in syrup, in milk, in molasses, or mixed with honey. Small doses of sulphur have an *alterative* effect, and in cases in which digestive disturbances are due to *disordered* or *suspended hepatic function* sulphur may evoke good results. As an alterative the dose is from 5 to 20 grains. In *colic due to impaction of a gallstone*, or of any hepatic origin, daily doses of 5 grains tend to alleviate the symptoms. In cases of *chlorosis*, when iron is not well borne or has failed of its effect, sulphur may be given in alterative doses. As a stimulant to the bronchial mucous membrane in *chronic bronchitis*, sulphur has some reputation. The formula of Germain Sée is given here:

℞ Precipitated sulphur..... 50 grains;
Extract of belladonna leaves.. 1 grain;
Powder of ipecac and opium. 5 grains;
Sugar..... 20 "
M. Make 10 capsules. Use from 2 to 10 capsules a day.

In *cystitis* and in *pyelitis* of tuberculous or calculous origin sulphur has been recommend-

ed and its use has been praised in the treatment of *derangement of the menses*. It has been alleged for sulphur that it relieves the muscular pains in *gout* and *rheumatism*. Combined with iodine, the iodides, or arsenic, it seems to produce beneficial results in *rheumatic arthritis*. The natural sulphur baths have long been reputed to be of benefit in rheumatism and gout, and in these ailments the warm baths seem productive of most good. For *skin diseases* it is likely that partial douching of the affected parts is more effectual than total immersion. The mineral waters containing sulphur are good as *laxatives*, since they usually contain the earthy and alkaline sulphates. In *muscular rheumatism* sulphur has had some use, but it is of doubtful value. What is known as *balsamum pulmonum* is a solution of sulphur in linseed oil to aid in the expectoration of a *chronic* or *acute bronchitis* with profuse sputum. In *habitual constipation*, *hæmorrhoids*, and *rectal hæmorrhages* Garrod advises the employment of a lozenge containing 5 grains of precipitated sulphur and 1 grain of cream of tartar. In *skin diseases* sulphur may be given for its tonic effect, and in *diseases of the nails* its use seems to be indicated to supply the element to those organs.

Externally or locally, the most efficient employment of sulphur is in the treatment of *scabies*. The agent destroys the path of the acarus and, as a sulphide, probably kills the parasite and its eggs. In the treatment of this parasitic disease the ordinary ointment of sulphur or the alkaline ointment may be used; it makes no difference in the result whether the element is used alone or in combination with alkalies, the main thing desired being the application of the sulphur to the diseased area. Hebra's perfected formula is here appended:

℞ Flowers of sulphur, } each .... 6 oz.;
Oil of cade, }
Green soap, } each ..... 1 oz.;
Lard, }
Chalk..... 4 oz.
M.

Before the application of this or a similar ointment the skin must be washed with soap and warm water. One inunction is made daily for a week, the clothing next to the body remaining unchanged. After seven days the patient should take a full bath and be inspected. Too vigorous use of the sulphur ointment may provoke a dermatitis which may be difficult to cure. An ointment containing sulphur has been recommended for a host of other skin diseases, among them *acne*, *alopecia areata*, *sycosis*, *psoriasis*, and *tinea versicolor*. In the first and last of these a treatment combining the application of an ointment and the use of sulphur baths is said to be particularly efficacious. *Tinea tonsurans* is said to be amenable to cure by the use of a sulphur ointment after the clipping of the hair. The fumes of burning sulphur are reputed to be beneficial in the treatment of inveterate forms of *eczema*, *psoriasis*, *impetigo*, and *prurigo*. For this method of treatment the patient's body, except his head, is inclosed and subjected to the sulphurous fumes.

The fumes of sulphur, like so many other agents, have been alleged to relieve the paroxysms of *whooping-cough*. *Amenorrhœa* of functional origin and *rheumatic* and *scrofulous affections* have been known to yield to the fumes of burning sulphur. Care must be taken when the agent is thus employed that a dermatitis does not arise.

Applied in the form of a powder, sulphur has been used since the days of Pliny as a remedy for *lumbago*. It is said to be efficient in the treatment of *sciatica* and of other peripheral nervous disturbances. Sulphur ointment, spread over the body in cases of *erysipelas*, *measles*, and *small-pox*, is said to allay the heat of the skin and the cutaneous congestion and, in the last-named disease, to disinfect the pustules.

Before the days of the specific treatment of *diphtheria* the insufflation of powdered sulphur was in high favour in the treatment of this disease and of *croup*. Bäumler, of Freiburg (cited in *Practitioner*, August, 1894), says that in diphtheria, judging from his observation in a large number of cases, sulphur is better as a local application than any of the other agents he has used. Sublimed sulphur, applied with a camel's-hair brush every two or three hours or insufflated an equal number of times, has uniformly given good results in his experience. To be of service it must be applied thick. Even in cases of gangrene of the uvula and of part of the soft palate he has observed an improvement in a few days. He adds that this method of treatment is best when the disease is confined to the fauces, but urges the insufflation of sulphur in cases of laryngeal diphtheria.

In the treatment of *tuberculous joints* and of *tuberculous osteomyelitis* sulphur has been used with excellent effect, applied as part of the dressing. In *infectious bone processes*, whether of tuberculous ætiology or not, an emulsion of sulphur and glycerin may be injected into the cavity and allowed to remain for twenty-four hours, with satisfactory results. *Ulcerative stomatitis* yields to the local application of sulphur. At a meeting of the Royal Medical and Chirurgical Society of London Mr. Lane reported the results of a year's experience with the use of sulphur in surgical practice (cited in *Medical News*, January 19, 1895). He found that neither sulphur nor its by-products had a deleterious influence upon the life or health of a patient. Its contact with recently incised healthy tissues for twenty-four hours sufficed to render the parts free from organisms. Advantageous results accrued from the local application of sulphur to parts poorly supplied with blood or already in a state of gangrene. In these instances the sulphur may be left on for a longer period of time. The same statement applies to granulating surfaces. Sulphur, says this author, destroys all organisms, whether free in a cavity or lying in the surrounding tissues. Finally, the action of sulphur is painless, says this surgeon. An ointment, *unguentum sulphuris*, is prepared

by the direction of the U. S. and Br. Ph's, the former consisting of 30 parts of sulphur and 70 of benzoinated lard, that of the latter containing 20 parts of sulphur and 80 of benzoinated lard. The Br. Ph. also recognises a *confectio sulphuris* containing 4 oz. of sublimed sulphur, 1 oz. of powdered acid potassium tartrate, 4 fl. oz. of syrup of orange peel, and 18 grains of powdered tragacanth.

Sulphur iodide, *sulphuris iodidum* (U. S. Ph., Br. Ph.), is a *local stimulant* and *caustic*. It is sometimes used topically in the treatment of *skin diseases accompanied with infiltration*. The Br. Ph. authorizes an ointment, *unguentum sulphuris iodidi*, consisting of 5 parts of sulphur iodide, 15 of solid paraffin, and 55 of vaseline. Bousquet (*Presse médicale*, July 15, 1896) suggests its employment as an *antiseptic*.

There are many preparations which contain sulphur or its derivatives. Thus, compound licorice powder, which is official, contains 8 per cent. of washed sulphur; ichthyol is rich in the element under consideration.

Potassa sulphurata, sulphurated potassa, is official in the U. S. Ph. It is prepared by the simultaneous heating of carbonate of potassium and sulphur. It is brownish in colour and has a most disagreeable, alkaline taste. Locally, potassa sulphurata is a powerful irritant; taken internally, it produces symptoms of irritation in the mucous membranes with which it comes in contact. It is employed in stimulating ointments in *skin diseases* of a scaly character and may be used to make sulphur baths, the strength varying from 1 to 3 oz. of the preparation in 15 gallons of water. Employed in too great strength, the baths produce dermatitis. The baths have been recommended in *rheumatism*.

Calx sulphurata (U. S. Ph., Br. Ph.), *calcaria sulfurata* (Ger. Ph.), or *calcium monosulphide*, is a pale-gray powder with a nauseous alkaline taste. It decomposes on exposure to the air. It is sparingly soluble in water. The drug has had a wide use, based on reliable clinical reports, in the treatment of *suppurative diseases*, of *boils* appearing in successive crops, and of *glandular enlargements* due to tuberculous invasion. The dose is from $\frac{1}{10}$ to $\frac{1}{2}$ of a grain, frequently repeated. This preparation is sometimes wrongly called "calcium sulphide."

[The action of the sulphides and that of sulphuretted hydrogen are essentially that of sulphur.]—Samuel M. Brickner.

SULPHURIC ACID, *acidum sulphuricum* (U. S. Ph., Br. Ph.), *acidum sulfuricum* (Ger. Ph.), is a highly corrosive liquid of an' oily appearance, employed largely in the arts and to some extent in medicine.

On account of the frequency with which it is met with it is often the cause of severe burns of the surface of the body and of death when accidentally taken internally. The symptoms caused by it do not differ essentially from those due to other corrosive substances, but, as a rule, the parts with which it has come in contact are blackened and charred. Magnesia, lime, and soap are the appropriate chemical antidotes, but to be of avail must be administered promptly. As an escharotic, sulphuric acid is hardly to be preferred to nitric acid, as by itself it penetrates deeply and is not easily controlled. Combined with charcoal (Ricord's paste), asbestos (Michel's paste), saffron (Velpeau's paste), or zinc sulphate, it is more manageable and may be used in the treatment of *chancres* and other superficial lesions requiring cauterization. A liniment containing about 1 part of the acid to 3 parts of olive oil is a decided *counter-irritant*.

Diluted sulphuric acid, *acidum sulphuricum dilutum* (U. S. Ph., Br. Ph.), *acidum sulfuricum dilutum* (Ger. Ph.), and aromatic sulphuric acid, *acidum sulphuricum aromaticum* (U. S. Ph., Br. Ph.), are practically of the same strength and are adapted to the same purposes, the latter, however, being rather more agreeable to the taste, as it contains small amounts of ginger and oil of cinnamon.

When the action of a mineral acid is desired in disturbances of digestion it is not advisable to employ sulphuric acid, as, although it may afford temporary relief, its prolonged use is followed by interference with the functions of the gastric juice. The same may be said of its employment in fevers. In such conditions hydrochloric or nitrohydrochloric acid is preferable.

It is, however, of decided value in the treatment of nearly all forms of *diarrhœa*, provided the dose is not large, especially when combined with opium or carminatives, and it is particularly useful in *Asiatic cholera* and the *diarrhœas prevalent during an epidemic of cholera*. In the latter conditions small doses, from 3 to 5 drops, of the diluted varieties may be given every half hour until a beneficial action has been observed. As a prophylactic against cholera, it is usually held in high esteem. Persons exposed to the contagion may drink freely of a 1- or 2-per-cent. solution, which may be sweetened if it is desired.

In the treatment of *colliquative sweating* sulphuric acid is sometimes employed with good results, and also in *hæmorrhages* of various kinds.

The cathartic properties of magnesium sulphate are increased by its combination with this acid. The dose of either the aromatic or the plain diluted acid is from 10 to 30 drops, well diluted.

[A somewhat stronger preparation is the modern form of *Haller's acid elixir*. The *mixtura sulfurica acida* (Ger. Ph.), *mistura sulphurica acida* (N. F.), consists of 1 part of sulphuric acid and 3 parts of alcohol. The dose is from 5 to 20 drops.]

Sulphates, or combinations of sulphuric acid and bases, are, as a rule, freely soluble in the ordinary menstrua, and are generally more or less *astringent*. The sulphates of the organic bases are usually soluble in water, and those which are not are rendered so by a small amount of sulphuric acid, a soluble bisulphate usually resulting. The alkaline sulphates are *cathartic*, while those of the metallic bases depend upon the metal for their therapeutic action.—Russell H. Nevins.

SULPHUROUS ACID, *acidum sulphurosum* (U. S. Ph., Br. Ph.), is a 6·4-per-cent. solution of sulphurous-acid gas (sulphur dioxide) in water. It is a colourless liquid having the odour of burning sulphur. It should be kept in dark amber-coloured, glass-stoppered bottles in a cool place and away from the light. It is an energetic *antiseptic* and *germicide*. It is chiefly used as a topical application in cases of *tinea versicolor*. The undiluted solution may be rubbed on the affected skin once or twice daily; if it is to be applied continuously, it should be diluted with three or four times its bulk of water. Internally, the acid has been used to some extent in the treatment of *fermentative dyspepsia* and *hay fever*. The dose is from ½ to 1 fl. drachm, largely diluted.

The **sulphites** are more suitable for internal use than the acid, since they give off the acid in a nascent state in the stomach. They may be given, dissolved in an abundance of water, in daily amounts of 15 grains. The sodium compounds, *sodii sulphis* (U. S. Ph., Br. Ph.) and *sodii bisulphis* (U. S. Ph.), are most commonly used. A 10-per-cent. solution of sodium sulphite has been employed as an *antiseptic*.

SUMACH BERRIES.—See RHUS GLABRA.

SUMACH, SWEET.—See RHUS AROMATICA.

SUMBUL (U.S. Ph.), *sumbul radix* (Br. Ph.), or musk-root, is the root of *Ferula Sumbul*, an umbelliferous herb indigenous to the mountains between Russian Turkestan and Bucharia. Sumbul is a *stimulant* to the nervous system, also a *tonic*. It has been used in *cholera*, in *asthenic diarrhœa* and *dysentery*, in *delirium tremens*, in *hysteria*, in *neurasthenia*, and in *chronic bronchitis*. The dose of the powder is from 2 to 8 grains; that of the tincture, *tinctura sumbul* (U. S. Ph., Br. Ph.), is from 10 to 30 minims. There is a non-official extract, the dose of which is a grain.

SUPPOSITORIES.—These are solid bodies intended to produce a local action by the gradual liberation of some active constituent held in solution or suspension in a medium which fuses more or less slowly at the temperature of the body. According to the place of application, suppositories are of various shapes and sizes. *Rectal suppositories* are usually of a conical or double-cone shape and should weigh about 15 grains. *Vaginal suppositories* are globular, and should weigh about 45 grains. *Urethral suppositories* are pencil-shaped, and should weigh about 15 grains.

Suppositories are usually made with cacao butter as the base. Frequently, also, a mixture of gelatin and glycerin is used. Suppositories may either be rolled by hand, cast in moulds, or formed by pressure.

Rolled or hand-made suppositories are prepared by grating or scraping the required quantity of cacao butter into a mortar, then adding the prescribed amount of medicinal substance, either in fine powder or in the form of a smooth paste, and mixing the whole thoroughly to a sort of pill mass, which is then rolled out to a cylinder. This is cut into the intended number of pieces, and each piece then rolled into a cone. To prevent adhesion, particularly in warm weather, the mass must be rolled in lycopodium or some other neutral powder.

Moulded or cast suppositories are prepared by melting the necessary amount of cacao butter and incorporating with it the medicinal ingredient either in powder or in the form of paste, or in solution in some liquid which will mix with the cacao butter (such as oleic acid, olive oil, etc.). The moulds having been prepared by carefully cleaning and wiping them with an oily cloth, they are filled with the melted mass, which must be not too far from the congealing point. It is best to fill them to overflowing, as the mass shrinks a little in the centre of the base on cooling. And if the medicinal constituent is a heavy powder, the mass must be constantly stirred in the capsule from which it is poured. The moulds are then placed on ice and, when the suppositories are sufficiently set, freed from the excess of adhering mass, whereupon the suppositories are removed.

Pressed suppositories are prepared in special hand-machines. The mass is made in the usual manner and introduced into the apparatus, where it is allowed to set. By means of certain pistons or plungers the mass is then forced into moulds by pressure. Various machines are in use for this purpose, but they all work on the same principle.

In warm weather, or when too much of a soft or liquid mass is to be incorporated with a given amount of cacao butter, some wax or spermaceti must be added to give consistence to the mass. This addition, however, must be carefully adjusted to the circumstances of the case. The melting point of the mass should never be higher than 95° F.

For a number of years past some firms have put various sizes of ready-made hollow suppositories on the market, which are intended to be filled with the medicinal mixture. They are very convenient, but care must be taken that the filling is of the proper composition, so that when the outer mantle is melted off the intended action upon the mucous membrane may take place in the manner desired.

For urethral suppositories, or bougies, gelatin is usually preferred, as it is not so likely to break or crumble while being introduced. Gelatin of the best quality is soaked in water until it has been softened, and the excess of water is poured off. For every 12 parts of soft gelatin 5 parts of glycerin are added, the mixture is melted in a water-bath, the medicinal substance is then added, and the mass is poured into a suitable mould or into glass tubes the interior of which has been coated with oil. When the mass has been thoroughly cooled it may be removed from the glass tubes by means of an oiled glass rod.

The U. S. Ph. gives only one working formula for a special kind of suppository, but gives general directions for all others. *Glycerin suppositories* are directed by the U. S. Ph. to be made in the following manner: 3 grammes of sodium bicarbonate are to be dis-

solved in 60 grammes of glycerin in a capsule on a water-bath; then 5 grammes of stearic acid are to be added, and the whole carefully heated until this is dissolved, and no more carbonic-acid gas escapes. The mass is then to be poured into suitable moulds, so as to produce ten suppositories. When they are set, each should be wrapped in tin foil and introduced into a glass tube to be corked at each end.

Dieterich recommends preparing glycerin suppositories by mixing 90 grains of finely powdered stearin soap with 3 oz. of glycerin, heating until solution has been effected, making up any loss by evaporation of water, and then casting in moulds. This quantity is intended for from twenty-five to fifty suppositories. (Cf. CACAO BUTTER.)

CHARLES RICE.

SUPRARENAL CAPSULE.—The suprarenal capsule and an extract prepared from it have been further used since the article on ANIMAL EXTRACTS AND JUICES was written, and various observers have published accounts of their experience. In a communication presented to the Physiological Society, of London, on March 16, 1895 (*Journal of Physiology*, April, 1895), Dr. G. Oliver and Professor E. A. Schäfer referred to some earlier experiments showing that when an extract, whether prepared with water, alcohol, or glycerin, of the suprarenal bodies of the calf, sheep, or dog was injected—even in very small quantities—into a vein in a dog or a rabbit the following pronounced physiological effects were produced in a few seconds: 1. Extreme contraction of the arteries, which was shown to be of peripheral origin. 2. A remarkable and rapid rise of the arterial blood-pressure, which took place in spite of powerful cardiac inhibition, and became further augmented when the vagi were cut. 3. Central vagus stimulation, so pronounced that the auricles came to a complete standstill for a time, although the ventricles continued to contract, but with a slow, independent rhythm. 4. Great acceleration and augmentation of the contraction of the auricles and ventricles after section of the vagi, the auricular augmentation being especially marked. 5. A slight change in the respiration, which became shallower.

A large number of subsequent observations made on dogs, cats, and rabbits had confirmed these results. As in their earlier experiments, watery decoctions of the glands had been chiefly employed by them. The suprarenals experimented with were derived from the calf, the sheep, the dog, the cat, the guinea-pig, and man. The physiological results were exactly the same whatever the source of the glands, except with regard to two which were taken from subjects of Addison's disease. The following effects are given by the authors: 1. As a rule, when the intravenous mode of administration was adopted, a definite small quantity of the extract representing a known weight of the fresh gland was injected. In exceptional instances, however, a continuous flow of a 5-per-cent. solution of the extract was employed. In these instances the physiological effects were maintained during the entire time the injection lasted, but without the development of other apparent symptoms and without causing death. In this way large doses of the extract were administered to the dog, thereby producing the most violent cardio-vascular disturbance without causing a fatal result. 2. In a former communication the inference as to the extreme contraction of the arteries had been derived from observations on the blood-pressure, from the use of the limb plethysmograph, and from the arrest of the flow of normal saline solution through the vessels of a frog caused by the addition of a small quantity of suprarenal extract. Several observations with the oncometer had confirmed this conclusion and shown that it might be extended to the vessels of the kidneys, for the tracings showed a well-pronounced reduction in volume of that organ during the suprarenal effect on the circulation. 3. It was observed that stimulation of the depressor nerve did not produce the usual reduction of the blood-pressure while the effects of the suprarenal injection lasted; if the depressor nerve in the rabbit was stimulated at the height of the pressure caused by intravenous injection of suprarenal extract, the usual fall of blood-pressure was not produced, and no depressor result was to be obtained until the blood-pressure had again become nearly or quite normal. The depressor result reappeared simultaneously with the Traube-Hering curves, if these were seen at all in the tracing. 4. It was invariably found that the heart's action was remarkably accelerated and augmented in the dog, the cat, and the rabbit after section of the vagi. It was not found that solutions of less than 1 per cent. of suprarenal extract in Ringer's circulating fluid would affect the frog's ventricle with certainty, recording its pulsations in a heart plethysmograph. The following results, however, were obtained with this and with stronger solutions—up to 5 per cent.: 1. Reduction of diastole, with consequent acceleration. 2. The abolition of groups of contractions and the setting up of continuous pulsation. 3. The arrest of the ventricle in systole. As this extreme effect of the extract was not prevented or antagonized by potassium chloride, the conclusion was that it was due to calcium salts in the extract, for Ringer had shown that the calcium effect upon the contraction of the frog's ventricle was counteracted by potassium. Moreover, the individual contractions did not show the characteristic calcium effect. On the contrary, each individual contraction remained normal, although the acceleration produced by the drug might ultimately be sufficient to prevent the completion of the diastole, and the contractions might thereby be caused to run together. 5. The paralyzing effect of the subcutaneous injection of the extract—about 1 or 2 grains—in the frog had not been observed in other animals experimented on in this way, except from lethal doses in the rabbit. It had been observed, however, in dogs subjected to intravenous injections of the extract, that when the muscles were electrically stimulated through the nerve supplying them, a modification of the normal

contraction was apparent, the relaxation being delayed, as in the case of the frog's muscle. This effect, moreover, not only was observed while the suprarenal rise of the blood-pressure was being recorded, but was traceable for some time after that rise had passed away. It was therefore inferred that the active material was probably taken up by the muscular tissues and remained for a time stored within them. 6. No definite effect upon the secretion of the submaxillary gland was observed as the result of injecting suprarenal extract into the blood. The chorda tympani was not found to be any less active in promoting the secretion of the gland in an animal the blood-vessels of which were contracted by the extract. 7. It was found that when two extracts were prepared of equal strength, one of the cortex and the other of the medulla of the perfectly fresh gland, the intravenous injection of the former would not produce the characteristic cardio-vascular disturbance, while that of the latter in the same dose would induce it in a marked degree. It is, however, the authors say, somewhat difficult to prepare the cortical extract perfectly free from a trace of the medulla, so that it may happen that a comparatively large dose of cortical extract may produce a slight physiological effect; but not more than that of a much smaller portion of the medullary extract. The conclusion, therefore, is that the active principle of the extract is present in the medulla only, the effects obtained from the extract of cortex being small and inconstant and probably to be explained by accidental contamination or post-mortem diffusion. 8. Experiments were made with suprarenals from three subjects—one in which the glands were healthy, and two others in which they were diseased (cases of Addison's disease). The healthy organs yielded an extract of great physiological activity, whereas the diseased adrenals afforded one which gave no result. 9. In regard to the oral administration of the extract as a remedy, it seemed desirable to ascertain whether peptic digestion impaired its active properties. A little of the watery extract of the gland was added to artificial gastric juice (pepsin + 0·2 per cent. of hydrochloric acid) and exposed to a temperature of 104° F. for twenty-four hours. The intravenous injection of a small quantity of this and of an equal portion of the same extract diluted at the time to the same extent with 0·2 per cent. of hydrochloric acid produced identical physiological effects. The injection of an equivalent amount of acid as a check experiment produced no effects. The authors, therefore, do not think it likely that gastric digestion will seriously lessen the physiological properties of the extract. Experiments were made with the view of ascertaining how the extract was eliminated or disposed of, and whether the active principle was destroyed in the blood. This seemed not improbable, as it was found that alkalies and oxidation destroyed the activity of the extract. It was observed, however, that when allowed to stand in freshly drawn blood with free exposure to the air, or with complete exclusion of air for twenty-two hours, the extract possessed the same activity as when preserved in exactly the same manner in normal saline. As an altered contraction of the muscles was observed to persist after the subsidence of the cardio-vascular disturbance set up by the injection, it seemed probable that the active principle of the extract passed out of the blood into the muscles, and remained there for a time.

The authors have shown that in *Addison's disease* the adrenals may become totally devoid of the physiologically active material. If these bodies are to be regarded as eliminators of toxic materials rather than as producers of materials which are of definite physiological value, they say the toxic materials they should remove or destroy might be expected, in cases in which their function is in abeyance, to pass out by the kidneys. They have found, however, that an extract prepared from the urine in Addison's disease has precisely the same effect when injected into a vein as that of an extract prepared from normal urine. In fact, all the evidence they have leads them, says Dr. Oliver, to view the function of the suprarenal bodies—at least the medulla—as secretory rather than destructive, and the secreted product as being in all probability of great physiological importance for maintaining the tonicity of the muscular tissues in general, and especially that of the heart and arteries.

Dr. Richard C. Cabot, of Boston (*Medical News*, September 12, 1896), has collected accounts of twenty cases of the treatment of Addison's disease with suprarenal-capsule preparations. In nine of them the patients have been considerably improved. He thinks that the various fluid extracts are very inferior to the gland itself, dry or raw.

Tonoli (*Gazzetta medica lombarda*, August 17, 1896; *British Medical Journal*, October 24, 1896) reports the case of a woman, aged twenty, who had suffered from Addison's disease for some fourteen months. When seen she presented all the classical signs and symptoms of the disease. On February 26th 20 grains of the powdered suprarenal capsule were directed to be given daily in pills, the dose being gradually increased to 2½ grains. On March 6th the patient already felt better; the pains in the stomach and lower limbs had disappeared. By March 31st the pigmentation had become less marked, the appetite was better, and the strength had increased. On April 10th she walked well, and her strength was much greater. The menses returned after ten months' absence, and her weight increased. The patient then went out, and the treatment was suspended. Meantime the temperature had come down to normal, the weight had increased decidedly, the black patches had disappeared from the mucous membrane, and the slight signs which had first been noticed at the apices of the lungs had disappeared. The author considers this was a case of cure (so far as it went), and not a mere spontaneous remission in the course of the disease.

In the *Journal des praticiens* for April 18, 1896, M. Huchard, writing on the use of the suprarenal capsule in *neurasthenia*, remarks

that Brown-Séquard's experiments and the more recent ones of Abelous, Langlois, and Albanese established the fact that the physiological function of the suprarenal capsules was to transform or to destroy the toxic substances which are produced in the organism under the influence of muscular activity and of the nervous system. We may thence understand, he says, why the destruction of these organs experimentally or by disease is capable of causing in the organism an accumulation of toxic agents which is the principal cause of the sensation of extreme fatigue and of the profound and generalized asthenia experienced by patients who suffer with Addison's disease. In neurasthenia, then, he says, patients may be benefited by this treatment.

Up to the present time, says M. Huchard, the observations have not been numerous enough to permit of absolute conclusions on the results obtained, but he thinks the remedy is worthy of attention. He thinks that the treatment should be persevered with, not only because it seems to be indicated by pathological physiology, but because it has not yet given rise to accidents when used in moderation. The fresh gland, to the amount of from 15 to 30 grains a day, may be taken by the mouth.

Dr. W. H. Bates, of New York (*New York Medical Journal*, May 16, 1896), has employed an aqueous extract of the suprarenal capsule of the sheep topically in various diseases of the eye. The extract used by him is prepared by subjecting the dried and powdered suprarenal capsule of the sheep to the action of cold water for a few minutes, filtering the liquid, and evaporating it to dryness at a temperature below 105° F. It requires 16 oz. of the fresh glands or 8 oz. of the powdered desiccated glands to make an ounce of the aqueous extract.

The active principle of the suprarenal gland is described by Dr. Bates as very soluble in water, 1 part of the extract dissolving in somewhat less than 3 parts of water. It is insoluble in strong alcohol, but soluble in dilute alcohol on account of the presence of water. It is also insoluble in ether or chloroform. The dried extract has remained immersed in strong alcohol, in ether, and in chloroform for several months without apparent injury. The dried aqueous extract is brown. The colour depends partly on the temperature at which it is dried; the higher the temperature, the darker the colour. It does not crystallize. When moist, it is slightly sticky; when dry, it is brittle. It has a slight odour resembling that of extract of beef. The most characteristic chemical property is its reaction with tincture of iron. A drop of tincture of chloride of iron added to a neutral solution of the aqueous extract produces a green colour which gradually disappears. A precipitate is formed, and the addition of more of the iron solution may produce the green colour again, with the formation of more of the precipitate. The supernatant fluid loses its colour at the same time that the precipitate is formed. Finally, it is possible to add sufficient tincture of iron to make the solution of the extract clear, and the addition of more iron does not produce the green colour. The precipitate contains the extract and the iron, because the filtered fluid evaporated to dryness leaves no residue except the excess of iron. The precipitate is black and is composed in part of metallic iron, probably. Dilute hydrochloric acid dissolves the precipitate and the solution becomes reddish.

Dr. Bates's explanation of these phenomena is that the extract is a strong reducing agent. The green colour, he thinks, is due to the fact that the red perchloride is reduced to the green sesquichloride by the extract. It changes to the black of metallic iron by further reduction with the extract. What becomes of the extract will require further experiments to determine. The reducing action of the extract he regards as remarkable. The reaction of tincture of iron with the extract is very delicate. A solution of less than 1 per cent. of the extract will produce the green colour on the addition of tincture of iron. If the extract is in a very strong solution, it may reduce the chloride of iron to the metallic state so quickly that the green colour may not be observed. This reaction, says Dr. Bates, does not occur with solutions of the thyreoid, thymus, testicle, or pineal gland.

The extract does not keep unless it is sterilized. It is incompatible with mercury bichloride, silver nitrate, copper sulphate, and other astringents; indeed, Dr. Bates declares that it "does not act well when combined with other substances." When he used it in solution with cocaine, he found that the eye was irritated and not anæsthetized, and he thinks that in such a solution the medicinal properties of both drugs are impaired.

The extract employed by Dr. Bates may be administered by the mouth in considerable doses without harm resulting, but large doses, particularly if given subcutaneously, may produce alarming results. A lady, aged eighty-seven years, had a pulse of forty, which was intermittent and irregular; after the extract had been used in the eye for a few days the pulse became regular, increased to eighty, and remained so during a period of six months that the extract was used. A woman, aged thirty years, swallowed 60 grains at one dose. She vomited immediately, but felt no other ill effects. A man, aged sixty years, after taking 2 grains three times a day for a week, was suddenly attacked with a peculiar eruption on his hands, which disappeared in ten days without treatment after stopping the use of the extract. In one case 10 grains given subcutaneously produced alarming symptoms. The face was livid; there was great pain in the head and chest, with a feeling of throbbing. Consciousness was not lost. The pulse was weak. In ten minutes the patient felt able to walk home from the dispensary, a distance of more than a mile.

Dr. Bates regards the extract as a powerful *astringent* and *hæmostatic*. When it is instilled into the eye the conjunctiva of the globe and lids is whitened in a few minutes. The effect is very decided. None of the usual astringents, including cocaine, he says, can produce such an astringent effect. In normal

eyes the extract whitens the conjunctiva and sclera when used in very weak solutions—less than 1 per cent. The effect is increased by repeated instillations or by the use of stronger solutions.

He mentions the following diseases of the eye in which the extract has whitened the conjunctiva and sclera: *Trachoma, acute catarrhal conjunctivitis, chronic conjunctivitis, phlyctænular conjunctivitis* and *keratitis, interstitial keratitis, rheumatic* and *syphilitic iritis, episcleritis, irido-cyclitis, sympathetic ophthalmia, atrophy of the globe, secondary glaucoma, traumatic conjunctivitis, traumatic keratitis, traumatic iritis, traumatic kerato-iritis, lacrymal inflammations*, and *rheumatic ophthalmia*.

The extract is not irritating. It generally produces a cooling sensation when dropped into the eye. It does not dilate or contract the pupil, and it has no effect on the accommodation. A tolerance was not established in two cases in which the extract was instilled into the eye several times daily for more than three months. A third patient used the extract daily for more than twelve months, and it whitened the eyeball and palpebral conjunctiva as well at the end of the twelve months as at the beginning. The astringent effect of the extract on the conjunctival vessels is temporary—usually in an hour the eye looks as it did before the extract was used. There is no congestion after the astringent effect has passed off.

Dr. Bates is not positive that the extract is curative in any form of *conjunctivitis;* but the immediate effect of its employment is very grateful to the patients. He has found it of material benefit by reducing congestion in *interstitial keratitis, glaucoma secondary to cataract extraction*, and *iritis*, and as an adjuvant to cocaine. "An operation on some nervous people is unsatisfactory, because cocaine does not produce anæsthesia. Such cases are quite common. A woman was operated upon recently for tenotomy of the inferior rectus. The cocaine did not whiten the ocular conjunctiva, dilate the pupil, or produce anæsthesia after being instilled frequently for an hour. A few drops of the extract whitened the ocular conjunctiva, and the cocaine in five minutes dilated the pupil and produced anæsthesia. The operation caused no pain. Traction on the tendon of the muscle with the hook was not painful. There was very little hæmorrhage. A previous operation on the same muscle, using cocaine alone, was painful, and there was an unusual amount of hæmorrhage. The eye was bleeding six hours later. The eye was sore for two days. The extract in this case had a very happy effect by securing a painless operation without hæmorrhage and without soreness afterward."

Dr. Bates adds that an operation which requires more than a few minutes becomes painful in some cases, although cocaine may be instilled frequently. Advancement of an ocular muscle, he remarks, is generally so painful that many operators are compelled to use ether anæsthesia. The operation may begin painlessly, but subsequently the anæsthesia wears off, particularly if there is *hæmorrhage*. The extract, when frequently instilled, prevents hæmorrhage, and the cocaine anæsthesia is prolonged indefinitely for this reason. As soon as bleeding occurs, one notices very soon the sensitiveness of the eye returning. A number of advancements have been done painlessly and almost bloodlessly by the use of the extract and cocaine together.

The extract prevents hæmorrhage, says Dr. Bates, because of its property of contracting the small arteries. After hæmorrhage begins it is not very efficient. It is possible to perform an almost bloodless operation on the ocular muscles or lacrymal sac by instilling the extract frequently. The following case illustrates its value as a hæmostatic: A man was operated upon four times during three months for stricture of the nasal duct. After each operation the patient lost enough blood to saturate two towels and sometimes more. The hæmorrhage was unusually copious, and the operations were very painful. A fifth operation was done in which the suprarenal extract was used with the cocaine. There was no pain and very little hæmorrhage. The towel used had on it one spot of blood a quarter of an inch in diameter.

SWEET OIL.—See OLIVE OIL.

SYMPHOROL.—The symphorols include sodium sulphocaffeinate, lithium sulphocaffeinate, and strontium sulphocaffeinate, but the first-mentioned, called also sodium caffeine-sulphonate, is ordinarily meant. It is a crystalline, bitter, non-poisonous substance, acting powerfully as a *diuretic*. The dose is 15 grains, to be given from three to six times a day.

SYMPTOMATIC TREATMENT.—The symptomatic treatment of disease involves, in a certain degree, a confession of ignorance of cause and effect, since it is an acknowledgment that the ultimate ætiology has escaped detection, and that it is therefore impossible to attack the fountain of origin. This does not imply that the pathology of a disease, which we are forced to treat as its symptoms arise, is ill or not at all understood; for although the morbid history may be perfectly clear, the therapeutic resources at our command may not be such as to admit of our applying them with invariably successful results. In consideration of repeated observation and of manifold experience, certain substances which relieve certain symptoms, increase function, or limit diseased processes are relied upon to furnish a basis for restoration to health in conditions in which we lack specific remedies. The term specific must not be loosely employed. Every drug, at least almost every remedy, has a specific action upon some portion of the human organism; but it can not be said to have a specific influence upon a disease as an entity unless by its innate virtues, without the intervention of other forces, it succeeds in limiting or eliminating the morbid process. Specific treatment is unfortunately limited at present to a few diseases. Quinine in malarial disease, mercury in syphilis, colchicum in gout, and antitoxine in diphtheria are specific; possibly the results of the administration of thyreoid extract in myxœdema and of

the salicylates in rheumatism may be regarded in a similar light. With these diseases and with these remedies the specific treatment of the present day comes to an end, unless one wishes to include in the category the homœopathic system, than which there is no more exquisite example of putative specific treatment founded on array of symptoms.

In the treatment of disease the fight against Nature has long since passed into deserved oblivion. The medical profession now recognises the force of the old Latin proverb, *Medicus curat, natura sanat morbos*, and directs its efforts toward assisting the healing power shown by Nature in diseases least influenced by artificial interference and in those which undergo spontaneous cure. Aside from the few exceptions cited above, in which accident, coincidence, or deductive inference has discovered a specific for disease, most physicians are obliged to treat disease from the symptomatic point of view. It is not too much to hope, in the light of recent investigation and experience, that within a few years the treatment of the infectious diseases, at least, will be placed upon a specific basis.

There is another sense, a broader and more generally accepted one, in which the phrase "symptomatic treatment" may be regarded. This refers to the alleviation of symptoms arising in the course or progress of a disease, not intended to be curative in its sequel, but simply and solely to combat threatening or serious manifestations and to allay disagreeable phenomena. For such measures to be thoroughly and conscientiously pursued, there must be a clear understanding on the part of the physician of the nature of the illness which is present. Thus, few men would be willing to risk the administration of chloral hydrate for the purpose of inducing sleep in pneumonia, or in any pronounced asthenic condition; and it would be a poor example of judgment which would allow a medical attendant to give strychnine for incontinence of urine to a child suffering from chorea, although under other condition of health or disease both of the drugs referred to might be legitimately indicated.

The pursuit of symptomatic treatment may lead into error, unless followed along lines of perfect knowledge of the processes presenting themselves. Sleeplessness, for example, in pneumonia may be due to disturbed nutrition, to high fever, to an embarrassed circulation or respiration, or even to pain. And successfully to combat this symptom, the physician must determine, as accurately as his skill and experience permit, the source of the insomnia. If it is due to continued fever, an earnest effort must be made to reduce the temperature, without, however, interfering with, embarrassing, or obstructing other organs or functions. If cardiac weakness is responsible for the distressing symptom, or if impeded respiration is the fault, appropriate remedies acting upon the organs concerned must be chosen. And yet, although the patient may feel restored and refreshed after the sleep which is given artificially, it must not be assumed that the measure is curative in any way further than that it conserves the patient's strength, and, like nourishing food, aids him to overcome the forces which are working against him.

It is by such reasoning that we find the purposes and objects of the symptomatic treatment of disease justified in their immediate and remote results. No physician of experience presumes to assert in any given case that a cure is certain, but he may, judging from his results in large numbers of cases, hope for a restoration to health, or a palliation of distress in many diseases—frequently fatal—by the careful, wise, judicious employment of measures which will allay or conquer grave symptoms.

There can be no more searching test of a physician's acumen and knowledge than the proper symptomatic treatment of disease. It involves not only an accurate acquaintance with the pathological and physiological processes at work, but also a well-grounded insight into the action, in health and in disease, of the therapeutic measures called into play. There must reside in the physician's mind an understanding of the constructive and destructive effects of disease upon nutrition, its influence upon and relation to the blood, the normal balance between these factors and the great vital functions of the body; excretion and secretion must be carefully observed and as closely watched, and the sustaining and reproducing functions of the organism must not escape consideration. In short, the physiology of disease must be as completely in the eye as the physiology of health. Nothing can supersede the knowledge which experience brings in the proper choice of remedies to meet disturbed conditions. The differences manifested by the action of drugs in health and in diverse conditions of disease are of very wide range, and in the administration of any medicine for the relief of symptoms all the changes and modifications induced by personal peculiarities, by absorption, and by influence on the various organs of the body must be judged of.

Bearing in mind that the purpose of the symptomatic administration of drugs depends upon two elements, the relief of immediate symptoms and through this the conservation of the patient's energy—in other words, the amelioration of *conditions*—renders the subject easy of comprehension. The relief of symptoms which threaten life or cause great discomfort is, all things considered, the first imperative duty of the physician, no matter what the *causa morbi* may be. *Pain* must be mitigated, from whatever source it springs—a pleurisy, a brain tumour, or an enteritis. By its depression and sapping of the patient's strength it may so lower the vital forces, if not relieved, that the subsequent struggle against the destructive agents of disease may be rendered futile. But even in the attempt to allay this symptom regard must be had for the effects of the chosen drug upon the organs involved. Though a general peritonitis—for instance, with paresis of peristalsis—may give rise to great pain, opium in any form would be contraindicated, since it would lead only to further difficulty in securing evacuation of the bowels.

rdinary colic, however, brought about bnormal collection of intestinal gases, le condition only must be met, and, h the bowel here, too, requires empty- contra-indication to the use of opium means so urgent, since no grave dis- reatens the strength of the sufferer. in the treatment of the symptom pain, as great a difference in the degree of erve lightning" in almost all diseases ir complications as exists in the two ns mentioned as examples. The highest nt must be called upon in this emer- s in the planning of any general outline nent.

ctual subjugation of pain would con- ts symptomatic treatment, and yet the nation of its source is an important ary step. When this can be ascertained ctly attacked, it is, of course, unneces- administer analgetic remedies unless conditions demand their employment. ays, in the attempt to obtund pain, the pon the disease and its possible com- ns must be duly considered, for little is y respite from this or any other symp- he subsequent result jeopardizes the patient or renders a recurrence of the n more likely.

e part of the brain, symptoms should dered and treated as they arise. *Deli- ma*, and *stupor* can not, however, simply ed as entities. Relief from the cause rst must be sought when this is pos- t no treatment should be instituted for nomenon which is apt, in the course of e, to increase a subsequent stupor or e condition. Delirium is but a symp- l as such is not in itself to be feared. the mark of some process whose influ- y lead to decrease of strength or of vital id hence must be fought as any other signal would be. The efforts, as in the nt of all symptoms of a grave nature, e directed to soothing the disturbed m. And the same remedy will not be efficacious. The delirium of an fectious disease or of agonizing pain ceive essentially different therapy from alcoholic intoxication or of mania. nd stupor arise from causes so mani- t in each individual case we must exer- areful consideration of the remedies re best fitted to arouse the dormant or forces. *Sleeplessness*, too, may de- on factors so varying that, when it is , the origin must be sought and the iate treatment be instituted. There is select field for the judicious choice of ial measure than in this very domain: g is contra-indicated in the presence of nother, in the face of delirium; another, ere is danger of a cardiac depression; next, in disturbed gastric function. Yet a is one of the direst symptoms to er, and, no matter in what disease or n it appears, it must be satisfactorily

heart and lungs during the course of of other organs, or when they them- selves are affected, give origin to symptoms which usually require therapeutic notice. Any embarrassment of the respiration, whether of local origin in the trachea or of cardiac source in an impaired heart, or local again in a consolidated lung, must be met and at once. Even when a dyspnœa depends upon some incurable disease, such as a malignant growth or an aneurysm, every intelligent effort should be made to relieve the threatening symptom. And the same rule holds true for any serious manifestation on the part of the heart. When weakened, through disease or innate conditions, it must be strengthened by appropriate means; when overworked or pumping against greater odds than it is able to overcome, suitable measures for its relief must be inaugurated. The conditions which are able to cause sudden cessation of the heart's beat in disease must be carefully watched for, and never, if it can be prevented, allowed to gain supremacy.

Cough is a symptom which may or may not demand therapeutic consideration, depending upon whether it is the sole symptom or one of a group of symptoms, and whether its presence is annoying, painful, or aggravating to the patient. If its source can be attacked and destroyed without damage to any of the functions or organs, therapeutic measures may be properly inaugurated. If it springs from a pleurisy, a pneumonia, or a pulmonary tuberculosis, it matters little how much the patient may cough if the distress is not great; but if a bronchitis, or a chronic pharyngitis, or a long uvula, or disease of the tonsils is the origin of the cough, that disease may itself be treated. In other words, if a cough represents the effort of Nature to assist in the elimination of deleterious material and does not cause the patient too much effort or pain, it may well go untreated; if, on the other hand, it is due simply to an irritation of the bronchial tract or part of it, the cough deserves and should have directed against it therapeutic interference.

Constipation or *diarrhœa* and *defective absorption* or *elimination* are such common accompaniments of many diseases that their symptomatic treatment is almost a matter of routine. And yet even these every-day manifestations of local or constitutional disease are frequently wrongly treated, since a diarrhœa may easily yield to a laxative which causes the removal of offending material, and a constipation be cured by giving the intestines a much-needed rest. In general, vomiting and nausea and the conditions already mentioned require deliberation of a careful kind, and usually demand treatment based upon a recognition of their causes. In this particular field of therapy, symptomatic treatment represents especially the treatment of conditions, since it is usually difficult to attack the disturbing element directly.

The limits of this article forbid an elaboration of the symptoms which may be evoked by disease in the several organs of the body. The underlying principles of the "rational empiricism" known as symptomatic treatment have been brought out, and a further multiplication of details is scarcely necessary. It may, how-

ever, not be out of place to emphasize the necessity, in this connection, of a careful watching of the general processes of the body, which, though they may not arouse special symptoms in the course of a disease, are yet so important in their bearings upon the causation of symptoms on the part of special organs that their consideration in any disease is part and parcel of the observation of the case. Reference is made, of course, to the metabolic processes; the proper exchange of gases in the blood and tissues; the correct elimination of waste and toxic products; the normal secretion and excretion of physiological fluids. A departure from the normal might not, in any given case, show symptoms; but eventually, if metabolism is impeded, all those evidences of a disturbance of nutrition so well known and easily recognised may make their appearance. Emaciation, glandular enlargement, an excess of urea in the urine, a feeble heart, diminished secretion of bile, and the numberless other concomitants of malnutrition would make themselves felt. The physician should hold himself responsible for the non-appearance of this condition by observing closely the catabolic necessities of the body during the entire progress of an illness. In this direction symptomatic treatment becomes prophylactic at times, and than this there can be no higher aim in medicine.

There still remain a few points toward which attention must be directed. Those conditions known as *asthenic* or *adynamic*, which may be part of any prolonged disease, acute or chronic, must always receive symptomatic treatment directed to the organs or sets of organs which are the principal seats of weakness. The treatment can not be specified, but must be general as indicated. If the heart shows signs of depression or failure, it must receive stimulants; if the intestines are weakened in their function, they must be strengthened. If there is exhaustion of the nervous system or of the muscular system or deterioration of the blood, these integers must be given the benefit of measures which will restore them or aid in restoring them to their normal condition. But whatever organ is thus found weakened in function, the therapeutic measure applied must be in proportion to the disturbance, and so chosen as to inflict no further injury upon the disabled organ or upon other organs; and this is of importance secondary only to that of the administration of *some* remedial agent. The giving of nourishing foods in the conditions under consideration may well come under this heading. No therapeutic agent at our command can replace the nutriment to be obtained from proper food-stuffs which contain, in a concentrated and easily assimilable form, the essential, elementary physiological requisites. Conditions of malnutrition which frequently follow the acute diseases commonly yield in a remarkable manner to judicious feeding; every organ and system of organs seems to respond almost immediately to the ingestion of the vital principles contained in the nourishment. It may be mentioned, too, that the proper nourishment of the sick during an acute illness is frequently, in more senses than one, a form of symptomatic treatment of higher value than the mere fighting of objective symptoms.

It has been considered better, in the course of this article, not to refer to groups of diseases or the individual maladies; but, by pointing out some of the broad principles which govern symptomatic treatment in general, to deduce the conclusions reached. To summarize briefly, it may be repeated that symptomatic treatment is indicated in all diseases or conditions whose processes give rise to local or constitutional manifestations, and whose seat of origin can not be attacked, or when, in our ignorance, we do not know how to attack it; or, in a more limited sense, when symptoms or conditions arise in the course of any illness the treatment of which is unable to overcome the phenomena of local or general origin. Even when a cure is out of the question, the judicious treatment of symptoms may provide comfort and prolong life.

SAMUEL M. BRICKNER.

SYNERGISTS. — These are remedies which in some manner aid or intensify each other's actions. The synergistic property was formerly held to be of great importance, and an attempt was usually made to modify the complex action of the drug chosen as the principal reliance and known as the base, by combining with it an adjuvant to increase the desired effect, and a corrigent to neutralize such effects as were undesirable. To succeed in attaining such ideal results a much more accurate knowledge of the exact action of each drug, and the proportionate influence exercised by it over the various organs of the body, as well as a genius for making accurate combinations, would be necessary to a degree not yet attained in the human race, and as the attempts made were usually to a greater or lesser degree failures to obtain the desired results, a severe simplicity has gradually taken their place and the plain drug, uninfluenced by adjuvant or corrigent intentionally introduced, is the rule of prescription-writing at the present day. Nevertheless, the advantage to be derived from the employment of remedies which are of assistance to each other is obvious.

It was the crude attempt to use the knowledge that most drugs produce many effects, of which some are beneficial but others deleterious in any given case, which caused those combinations of drugs that seem strange to us; but it is of great advantage to remember that many drugs produce similar even if not identical effects, and that by the combination of two, each of which produces a similar or identical effect upon a certain organ, a better result can be obtained than from either singly, because, as a smaller amount of each is needed, the other effects, whether deleterious or not, are produced in a minimum degree. Thus opium and ipecacuanha are both diaphoretics, while one is a narcotic and the other a nauseant. By combining them a better diaphoresis may be obtained than would be the case

if either were given singly, unless in sufficiently large doses to produce the other and undesired physiological effects. In the same manner manganese may be advantageously combined with iron to aid it in producing its hæmatinic effects. Sometimes the combination of a stronger and a weaker agent is of remarkable efficacy. Although cocaine can not compare with atropine as a mydriatic, still a more pronounced mydriasis may be obtained from their united action than from atropine alone, on account of the mechanical expression of blood from the tissue by the contraction of the blood-vessels induced by the cocaine.

This synergetic action of various drugs may possibly be explained in some cases by a close alliance in chemical composition, as is the case with metallic salts and with the members of the phenol group, or by the presence of identical or closely related alkaloids or active principles, such as that of berberine in calumba and hydrastis. But such a relationship is not always necessary in order that two drugs may enhance each other's effect upon the system, as is demonstrated by the frequent and useful prescription of iron with bitter tonics.

The employment of synergists in medicine should not be considered as confined to the prescription of drugs, which by their physiological action increase each other's force, but should also include all agencies by means of which the system is aided to respond to the influence of the medicament upon which reliance is placed. Thus digestive ferments employed to improve the digestion and so contribute to furnish assimilable material for the support of the body are distinctly synergistic to the means used to combat the disease from which the patient is suffering. The same is true of tonics, stimulants, the inhalation of oxygen, and all other measures which aim at the maintenance of the patient's strength and vitality. Water, when drank in large quantities as a diluent, is of valuable service in inflammation of the genito-urinary tract by flushing the emunctories and so permitting easier and better action of the organs.

Counter-irritation may frequently act synergistically by inducing a change in the nervous or circulatory condition of an organ, as when it is used in the lumbar region in cases of nephritis, that it may assist the kidneys to respond to the diuretics administered.

The regulation of other organs of the body than those primarily diseased is an important aid to the restoration of functional equilibrium, hence the use of laxatives, diaphoretics, and other eliminatives is frequently indicated. Emetics, cathartics, and general depletion favour the action of depressant remedies.

The synergistic effect of electricity in the rapid production of the local effects of cocaine, aconite, and other drugs has been mentioned and classed with other mechanical, chemical, and thermal aids to absorption, under SORBEFACIENTS.

Hygienic measures of all kinds, pure air, proper food, exercise, massage, the various forms of baths, are most valuable synergists to proper medicinal treatment, not including systemic depressants, and when properly carried out not infrequently become the principal instead of the accessory remedial measures. Unfavourable hygienic conditions increase the activity of drugs which depress the bodily functions.

Finally, the synergistic effect of mental emotion must be considered. The *modus operandi* here is difficult to explain, but it is universally acknowledged that a cheerful frame of mind is of much assistance to the action of restorative agents, while a mournful mood increases the force of depressant remedies.

MATTHIAS LANCKTON FOSTER.

SYNOVIAL EXTRACT.—Dr. Samuel Hyde, of Buxton, England, writes in the *British Medical Journal* for April 18, 1896, that he has had a glycerin extract prepared from the fresh synovial membranes and articular cartilages of healthy animals, and is using it as a remedy for *rheumatoid arthritis* and some other forms of chronic joint disease. He gives it by the mouth in doses of from 15 to 30 minims two or three times a day. He reports that thus far his experience with it is encouraging.

SYRUPS.—These are more or less concentrated solutions of sugar in water, in most cases combined with some flavouring or medicinal agent. They may be prepared by various methods. When heat is not objectionable, they are most expeditiously made by this agent. Otherwise simple agitation or percolation must be resorted to.

The hot process, if it can be applied to all, not only is the most expeditious, but produces the most stable product, as it destroys the vitality of any germs which may set up fermentation, or cause the formation of mould, etc., in the product. If it is necessary to avoid actual boiling in the preparation of a syrup, the product is usually not so clear and bright as would have been the case if the boiling point had been attained, because in the latter case the suspended matters would have all been carried to the top, where they could have been removed.

In the preparation of syrups containing volatile or easily decomposable medicinal ingredients, heat must be avoided. But such syrups, unless kept under special precautions, are very apt to deteriorate. It is therefore advisable never to prepare more of a stock than will supply the demand for a short time ahead.

The preservation of syrups is best accomplished by keeping them in completely filled bottles, each holding an amount sufficient for a few days' supply, which must be hermetically sealed and kept in a cool place. If the syrup can be introduced boiling hot into the bottles, previously well cleaned and immersed in hot water, it will keep so much the better. When it is necessary to clarify a syrup which is turbid from minute suspended matters, this may be accomplished, if heat is not objectionable, by mixing with it, while cold, an aqueous solution of white of egg and then raising it to boiling without stirring. As the albumen contained throughout the solution coagulates, it envelops the suspended matters and they are all carried

to the top in the form of scum. When heat cannot be used, the clarification is best effected by mixing the syrup with well-shredded and moistened paper-pulp, thoroughly agitating it during some time, and then filtering through paper or flannel. The first portions of the liquid may be returned to the mixture until it runs through clear.

In come cases the preservation of a syrup is secured by the addition of an acid, or of alcohol, or of glycerin.

Fruit syrups, which are largely used as flavouring agents in popular beverages, as well as in medicinal compounds, are usually prepared with the aid of a moderate degree of fermentation. As an example may be cited *syrup of cherries*, which is best prepared in the following manner: Crush the cherries, with their kernels, and let the mass stand in a covered vessel for two days at a temperature of from 60° to 70° F., stirring it occasionally. Then express the juice, add for every 100 parts of the latter 2 parts of sugar, and, when this is dissolved, pour the juice into one or more narrow-mouthed bottles or other convenient vessels of such a nature that only a small surface of the juice is exposed to the air, and tie parchment paper over the orifice. Fermentation will gradually set in, its rate depending greatly on the temperature, which should be so regulated that it will not be too rapid. The fermentation produces a certain amount of alcohol, which causes the gradual coagulation of the mucilaginous constituents. As soon as a small sample, say 4 c. cm., of a filtered portion of the juice is found to mix, without becoming turbid, with 3 c. cm. of 90-per-cent. alcohol, the process should be interrupted. The juice is now filtered as rapidly as possible, the filtrate is transferred to a suitable vessel, and for every 350 parts of filtrate 650 parts of sugar are added. The mixture is slowly raised to boiling and kept at this temperature until it no longer throws up a scum, which must, while it appears, be constantly removed. The finished product is then, while still hot, strained through flannel and immediately transferred to suitable vessels, which must be filled as far as possible and securely stoppered.—CHARLES RICE.

SYZYGIUM JAMBOLANUM. — See JAMBUL.

TABACUM.—See TOBACCO.

TABELLÆ, TABLETS.—Tablets are small disc-like masses of medicinal powders the basis of which usually consists of cane sugar or milk sugar. They are prepared either in moulds or by compression.

Moulded tablets, also called *tablet triturates* (more correct would be *triturate tablets*) are prepared by triturating an active substance with a sufficient amount of milk sugar (or, in some cases, other soluble medium), so that when they are moulded and finished, each tablet will contain the exact intended amount of the medicinal constituent. These tablets were first suggested and introduced by Dr. Robert M. Fuller, of New York, in 1878, since which time their use and manufacture have assumed immense proportions.

Since the tablets are usually of the same size, and since varying quantities of medicinal constituents occupy varying volumes, the maker has to devise a separate formula for each combination, so that a finished tablet will contain the exact dose of the medicine together with enough sugar of milk to make up the bulk of the tablet. The formula for each separate combination is arrived at in the following way:

The mould is filled with powdered sugar of milk, previously made into a pasty mass with alcohol. The mould itself consists of a plate of hard rubber, glass, or metal, of the exact thickness of the tablets to be formed. It is pierced by a number of parallel rows of round holes of the diameter of the desired tablets. On either side are two additional single holes. The plate is laid on a flat surface, the prepared mass is forced, by means of a spatula, into the tablet holes, and all excess of the mass is carefully removed. When the tablets are nearly set, the mould is brought over a plate containing cylindrical pegs exactly corresponding to the tablet holes, the proper guidance of the mould being accomplished by two longer pegs, one on each side, which fit into the lateral holes of the mould.

After the experimental tablets have been removed from the mould, they are thoroughly dried and weighed. They generally weigh 1·3 grain each, though this weight is slightly increased with any increase in the solvent action of the menstruum, since this causes more sugar to remain in a compact form in the tablet. Next it becomes necessary to ascertain how much milk sugar must be omitted from the ascertained amount to make room for the desired quantity of the medicinal ingredient. For this purpose 130 grains of milk sugar, corresponding to 100 plain tablets, are weighed off, and as much in bulk is removed from this as the apparent bulk of the medicinal substance to be added. The amount of sugar of milk removed is ascertained by weighing. The active ingredient, if a dry solid, is now mixed by thorough trituration with the remaining sugar of milk. In the case of solid extracts, tinctures, and other fluids, these are mixed with the remaining sugar of milk, and the whole is brought to a solution by a suitable menstruum, to insure uniform admixture. The solution is then evaporated and the residue reduced to powder.

When the powder or triturate is ready, it is wet with a suitable menstruum (see below) and moulded, care being taken that the *whole* mixture is transferred to the holes, which must *all* be filled, while *none* of the mass must remain over. In most cases this is only an experimental step, since, if there is either too much or too little of the mass, a new trial must he made, until there is just enough. But the proportions of sugar of milk and of medicinal ingredients thus ascertained will then hold good for the future, and it is only neces-

sary to keep a record of them for the particular combination in question.

If at this trial it was found that there was not enough mass to fill all the holes, the weight of the deficiency is ascertained by finding the average weight of the finished tablets and deducting the calculated weight of the missing tablets from the weight of the bulk of sugar originally removed from the 130 grains. At the next trial the quantity to be removed should be less by the amount represented by the weight of the missing tablets.

It is important that all the ingredients, as well as the mixture of powders ready for moulding, should be in the finest possible state of subdivision.

The menstruum selected for moistening the mass should have a *slightly* solvent action upon one or more of the constituents, but the latter should not be too freely soluble, since the mass is then moulded with difficulty, and the tablets are apt to be uneven or become too hard. The solvent action should be so regulated that the resulting tablets will not crumble when shaken together in a phial, and yet will readily disintegrate in water, either at once or at least after some time.

The menstruum generally used is absolute alcohol, alcohol and water, or chloroform. For tablets consisting nearly altogether of sugar of milk, a menstruum of 3 volumes of alcohol and 1 volume of water is the most suitable. The larger the quantity of insoluble matters which is present in the mass, the more must the proportion of water be increased, the object being to dissolve enough of the sugar of milk to hold the particles together. This is, for instance, the case with tablets of reduced iron, manganese dioxide, cerium oxalate, bismuth subnitrate, and similar substances. For tablets of codeine, leptandrin, aloin, etc., and bodies very soluble in alcohol, it is best to use only water.

When a chemical reaction is expected to take place, so as to produce a new substance which is the desired active ingredient, the menstruum selected should *not* dissolve *all* of the participants in the reaction, since the latter is expected to be completed in the stomach.

When the powder is ready, it is wet to a pasty condition by the most suitable menstruum, and then pressed into the holes of the tablet mould lying on the pill tile or other flat surface by means of a horn or ivory spatula which is drawn over the mould. Sometimes it will happen that the mass adheres to the spatula and is thus drawn out of the holes. This may be avoided or remedied by dipping the spatula in the menstruum used for moistening the mass, and then drawing it over the surface. The mould is then reversed by sliding it toward and off the edge of the tile, and the spatula applied to the other side in the same manner as before described. It is then applied to the peg plate (or pin plate), and the tablets are pushed out. They are allowed to dry for a few minutes on the pegs, then removed by striking the peg plate upon the counter covered with a sheet of paper to receive the tablets.

If the tablets are to be finished quickly, a current of heated air is allowed to pass over the side which is to rest on the pegs.

In drying tablets, it is best to use a sieve or wire cage, so as to permit of uniform drying on all sides. This is particularly necessary in the case of coloured tablets.

Hypodermic Tablets.—These may be prepared in a similar manner with sugar of milk or some inert mineral salt as the base.

Compressed Tablets, or Tabloids.—These consist of some medicinal substance or mixture, compressed in the form of discs. The substance in this case should not be in fine powder, but in a granular form, being brought to this condition, if necessary, by a special process.

Of course, if a mixture is to be brought into the form of compressed tablets, the ingredients must first be mixed most thoroughly by trituration to a fine powder, and then brought into a granular form. This granulation is generally effected by mixing the powder with one tenth of its weight of cane sugar and one twentieth of powdered gum arabic, and moistening with water until the mass is of such consistence that it can readily be forced through a No. 12 sieve without sticking to it or clogging it. When it has thus been passed through the sieve it is dried. The finished granulation, which must be perfectly dry, is now forced through a No. 20 sieve, and the particles which do not readily pass through are forced through by the aid of a flat pestle. In moistening the granulated powder, the water must be added uniformly throughout, best in the form of a spray and in small portions at a time.

Substances which can be bought already granulated, or may be brought to this condition by grinding and sifting, usually require no further preparation, and may be compressed at once—for instance, ammonium chloride, potassium bromide, sodium bromide, potassium chlorate, etc. In the case of the last-named salt, if it is to be combined with sugar, its dangerously explosive property must not be forgotten. No trituration or forcible compression of a *dry* mixture of the salt with sugar must be attempted.

Before the granulated substance is compressed, some lubricant must be added. The best has been found to be some hydrocarbon oil, which must be absolutely free from odour. A very small quantity is sufficient—about 10 or 12 drops for each pound of granulated mass. It is best added in the form of a fine spray and distributed by stirring the mixture. The particles thus become faintly lubricated and will be enabled to glide upon each other freely, easily falling into the mould space, feeding the same amount each time, and thus making the finished tablets equal in weight. The act of compression forces most of the oil to the surface of the tablet and lubricates the latter just enough to prevent it from sticking to the die. Finely powdered French chalk is generally used as an additional lubricant. It is added in small quantity, not to exceed 1 ounce for every 3 pounds, after the oil.

Various forms of compressed-tablet moulds

have been devised for preparing tablets on a small scale and for manufacturing purposes.

A very important quality which compressed tablets should possess is that of rapid disintegration or solution, except in the case of those (for instance, of potassium chlorate) which are intended to dissolve slowly. In order to facilitate their rapid disintegration, the mass to be granulated, if it requires it, is mixed with from one twentieth to one tenth of its weight of powdered starch. This is particularly necessary in the case of such substances as phenacetine, acetanilide, sulphonal, trional, etc., as they would produce scarcely any effect at all if solution had to proceed gradually from the outside of a solid tablet. Indeed, without this addition such tablets would be likely to pass through the whole intestinal canal without losing much substance.—CHARLES RICE.

TABLOIDS.—This is a synonym used in England to denote compressed tablets. Concerning the latter, see the article TABLETS.

CHARLES RICE.

TAKA-DIASTASE.—This is a powerful amylolytic ferment, prepared by a process similar to malting, devised by Mr. Jokichi Takamine, a Japanese chemist, from a fungous growth on wheat bran. It is a tasteless and odourless powder capable of quickly converting a hundred times its weight of starch into sugar, mostly maltose. It is used in the treatment of so-called *amylaceous dyspepsia*, and found to be exceedingly efficient. It may be given in doses of 2 grains, after eating. Dr. George Suttie, of Detroit (*Medical Age*, September 25, 1895), has reported a number of cases in which its employment proved highly satisfactory.

TALC.—What is generally known as talc, *talcum* (Ger. Ph.), is, properly speaking, steatite, or more probably a mixture of talc and steatite. As used in medicine, it is grayish-white in colour and has a greasy texture. It is employed as a dusting powder, either by itself or combined with small amounts of boric or carbolic acid, as a soothing and protective application in *intertrigo*, *eczema*, and various other irritated conditions of the skin, and is probably the best agent of its class, except when it is to be applied to a surface secreting any acid fluid, when magnesia or magnesium carbonate is preferable, on account of its alkalinity. It is especially adapted for use on parts where there is more or less friction, as its unctuous properties allow of the free movements of the surfaces upon each other. Purified talc, *talcum purificatum* (N. F.), is talc deprived of certain of its impurities by hydrochloric acid. It may be used as a filtering agent, and, under the name of "French chalk," it is very largely employed to remove grease from fabrics, being powdered and applied over the spot and allowed to remain for an hour or two.—RUSSELL H. NEVINS.

TALLOW.—Properly speaking, all animal fats that are solid at ordinary temperatures are grouped under this head, but the term is usually limited to the solid fats obtained from beeves and sheep. (See SUET.) The tallow obtained from the internal part of beeves is hardly suitable for medical purposes, as, unless prepared with great care, it contains more or less water, and speedily decomposes with the formation of various fatty acids that are irritating to the skin. That prepared from the adipose tissue surrounding the kidneys, the "short fat" of commerce, contains more stearin than the other varieties, and is the least objectionable.—RUSSELL H. NEVINS.

TAMARIND, *tamarindus* (U. S. Ph., Br. Ph.), *pulpa tamarindorum cruda* and *pulpa tamarindorum depurata* (Ger. Ph.), is the acidulous pulp of the fruit of a semitropical and tropical tree, the *Tamarindus indica*, which is mildly *laxative*. It is often combined with other laxatives, and enters into the composition of confection of senna. It may be given in doses as large as an ounce with safety, but larger amounts than that may give rise to griping. An infusion in water is an agreeable beverage in *febrile conditions*, when the stomach is in good order. Like nearly all vegetable preparations of the same class, it is moderately *diuretic*.—RUSSELL H. NEVINS.

TANACETUM.—See TANSY.

TANNAL.—There are two aluminum salts known under this name. The first, which is insoluble, is a *basic aluminum tannate*, $Al_2(OH)_4(C_{14}H_9O_9)_2 + 10H_2O$, a brownish-yellow powder formed, according to Professor Coblentz, by precipitating a solution of an aluminum salt with a solution of tannic acid in the presence of an alkali. The second, which is soluble, is *aluminum tannic tartrate*, $Al_2(C_4H_6O_6)_2(C_{14}H_9O_9)_2 + 6H_2O$, obtained, according to the same author, by treating insoluble tannal with tartaric. Both forms are *astringent* and *antiseptic*. The insoluble form is used by insufflation, and the soluble form in solution in *nasal*, *laryngeal*, and *pharyngeal catarrh*.

TANNALBIN.—This is a German proprietary preparation. Gottlieb (*Deutsche medicinische Wochenschrift*, March 12, 1896; *Therapeutische Wochenschrift*, March 29, 1896) describes it as a slightly yellowish, tasteless powder containing fifty per cent. of tannin, made by subjecting a compound of tannin and albumin to a heat of from 212° to 248° F. for five or six hours, whereby it acquires the property of resisting gastric digestion, while it still remains susceptible to the slow action of the intestinal juices. Von Engel (*ibid.*) has found it serviceable in all *diarrhœal affections* in which an *astringent* is indicated, especially *chronic intestinal catarrh*. It proved efficient in twenty-five out of twenty-nine subacute or chronic cases, and in nine out of ten acute ones. He reports that he has observed no harm from its use. The dose for adults is 15 grains, and that for children under four years old half that amount from two to four times a day. Vierordt (*Deutsche medicinische Wochenschrift*, June 18, 1896; *British Medical Journal*, July 4, 1896) has used tannalbin in some thirty selected cases, mostly of *subacute* or *chronic intestinal catarrh*, including *ulcerative enteritis*, occurring usually in young subjects. Regulation of the diet, other drugs as well as

other methods of treatment, such as injections, etc., had produced no good effect. The astringent action of the drug was well marked in the various forms of diarrhœa, even including cases of suspected *tuberculous ulceration of the bowel*. Inthe various forms of *enteritis* the stools became more solid and the mucus diminished, so that the dose of the tannalbin could soon be lessened and its use discontinued. In four cases in which cod-liver oil containing either creosote or phosphorus produced diarrhœa, the stools became solid and less frequent when tannalbin was given in addition. No unpleasant symptoms were produced by the tannalbin. The author discusses the possibility of a favourable action being exerted on internal organs, such as the kidneys, etc., when large quantities of tannin can thus be introduced into the body without inconvenience. Of five cases of *chronic renal disease*, tannalbin produced good effects in three. The drug does not produce constipation in the healthy alimentary canal. The author looks upon tannalbin as being the best tannic-acid preparation yet introduced. If a favourable action is not soon noted, the dose should be increased rapidly, the limit being 30 grains as a single dose, and 150 grains in the course of twenty-four hours. It may be given between or after meals in water or milk.

TANNIC ACID.—This is an organic acid obtained from nutgall (U. S. Ph.). It is known officially as tannin, *acidum tannicum* (U. S. Ph., Br. Ph., Ger. Ph.), gallotannic acid, and digallic acid. The term tannin, however, is usually restricted to a class of vegetable principles which have many differences among themselves in other respects, but are alike in causing a green or bluish-black colour or precipitates when ferric salts are added to their aqueous solutions, and form insoluble compounds with albuminous or gelatinous solutions. The tannin derived from galls differs from that from other sources by being converted into gallic acid on exposure to atmospheric air in a watery solution. Although tannic acid may be prepared from cinchona, tanacetum, kino, uva ursi, and the barks and roots of many other plants, the official product is derived from the nutgall. It is prepared by the action of ether upon the powdered nutgall and the evaporation of the product, without, however, being an ethereal extract.

Tannic acid may be derived from catechu and kino of the U. S. Ph., and from the elm bark of the Br. Ph. The variety of tannic acid obtained from these sources is known as *mimotannic acid*, which gives a greenish precipitate with neutral solutions of ferric salts. According to some chemists, an unfermentable sugar results from its decomposition, together with an acid a little different from ordinary gallic acid. Bael fruit, official in the Br. Ph., is said to be efficient in diarrhœal diseases because of the presence of tannic acid. The leaves of the edible Spanish chestnut contain about 10 per cent. of tannin. Among the other substances which contain tannic acid are the rind of the fruit of the pomegranate, hæmatoxylon, krameria, larch bark, the rhizome of geranium, sumach (in its leaves, stalks, and fruit), the winterberry, and the blackberry.

Tannic acid is a yellowish or yellowish-white, non-crystalline powder of a highly astringent taste. It is nearly odourless, or has but a faint odour of ether. Its formula is $C_{14}H_{10}O_9$. The acid is soluble in water, less soluble in alcohol and in ether; it dissolves in about its own bulk of glycerin. In solution it reddens litmus paper and it forms salts with alkalies. It precipitates albumin, starch, and gelatin, and furnishes, on the addition of a ferric-chloride test solution, a bluish-black precipitate or colour. Tannic acid burns with a brilliant flame and, heated on platinum foil, it leaves little ash.

The ready union of tannic acid with the vegetable alkaloids furnishes a test for the latter which is largely employed. It has a striking affinity for most of the mineral acids, forming precipitates. When it is rubbed with potassium chlorate an explosion of considerable violence ensues.

To distinguish tannic from gallic acid, the U. S. Ph. recognises two tests. One consists in adding to an aqueous solution of tannic acid a small quantity of calcium-hydrate test solution. The production of a pale bluish-white precipitate, which is not dissolved on shaking, shows a distinction from gallic acid. The other difference lies in the fact that tannic acid causes a precipitate with most alkaloids and bitter principles and with solutions of starch, gelatin, and albumin.

When tannic acid is applied to the skin or mucous membrane, in powder or in solution, it exerts a decided *astringent* effect. This is probably due to a contraction of the local blood-vessels, and the dryness of mucous membranes following its application may be attributed to the same influence. The astringent action is persistent for some time, and it may be that this influence is enhanced by the coagulation of the mucus and to the constriction of the mouths of the mucous follicles. The local astringent influence of tannic acid takes place on all mucous membranes, whether it is actually applied or taken internally. When it is ingested, it probably forms an insoluble compound, or one soluble with difficulty, with the acid juices of the stomach. These compounds, possibly albuminates, are slowly acted upon by the intestinal secretions, and the tannic acid may undergo changes which result in the production of gallic acid. After its administration tannic acid appears in the urine in the form of gallic acid, and one writer has recorded the finding of pyrogallic acid in the renal excretion after the ingestion of tannic acid. Locally, tannic acid is a more powerful astringent than gallic acid, and where it can be directly applied it is probably to be preferred, since the bulk of opinion inclines to the view that it is converted into its congener, gallic acid, when taken internally.

Individual susceptibility differs as to the effect wrought by tannic acid when ingested; but, although there are no fatal cases of poisoning recorded, there are a number of pub-

lished instances in which it has produced pain in the stomach and abdomen and, in a few cases, fever and a constitutional disturbance of a more or less severe nature. It can not, however, be included among the poisonous drugs, although large doses have caused a purulent diarrhœa lasting for some weeks.

Tannic acid is taken up by the blood as gallic acid, but the source and manner of its conversion are not known. For this reason, as stated before, tannic acid may be preferred to gallic acid when it can be directly applied, as to the skin, to the intestines, or to the lungs or throat by spray; but for general internal use gallic acid should be chosen.

Tannin is the chemical antidote of antimony, and where there has been *poisoning by tartar emetic* it should be given as promptly as possible in a strong solution. It forms a relatively insoluble precipitate with antimony, and with the vegetable poisonous alkaloids; but the precipitates are slowly dissolved in the intestines, and the tannic acid administration must therefore be accompanied by induced emeto-catharsis.

Locally, tannin has been recommended in a host of ailments. As a *local astringent*, it may be used whenever any drug of its class is indicated. Trousseau praised its use in the treatment of *chronic coryza*, in the form of a finely pulverized powder used as a snuff. A snuff containing 3 per cent. of tannin is also said to abort an impending coryza. In *epistaxis* its astringent action may control the hæmorrhage. Good results have been obtained in the treatment of *sore nipples* by using a 1-per-cent. solution. Tannin in solution, in varying mild strengths, has been successfully employed in *excoriations about the anus* and *scrotum*, in *fissures of the anus*, and in *hæmorrhoids*. Suppositories of tannin are of particular value in the last-named ailment, especially when the piles are irritated or inflamed. They become reduced in size, if at all susceptible to the action of astringents, and may completely disappear. *Prolapse of the rectum* has been treated in the same way with good results. Tannin as part of a gargle has proved valuable in cases of *hypertrophy* or *relaxation of the uvula*, and in *acute, non-exudative inflammatory conditions of the pharynx*. *Hypertrophied tonsils*, when not acutely inflamed, may be reduced in size in a similar manner or by the use of the glycerite of tannin, applied with a brush after a cleansing of the affected mucous membrane. In the treatment of *chronic* or *acute inflammation of the eyelids* tannin has been employed with alleged satisfaction. Druitt praised its use in the form of powder or the glycerite in the treatment of *aphthous ulcers* of the mouth and of *stomatitis* of whatever origin.

[Dr. M. A. Veeder, of Lyons, N. Y. (*Medical Record*, March 28, 1896), reports a rebellious case of extensive *suppurating sinuses* cured with a strong solution of tannin after various other applications had failed. At first a moderately strong solution was tried in one of the sinuses in the arm; it acted so satisfactorily that its strength was increased until it was nearly a saturated solution and the entire tract of the cavity was filled with it. The immediate effect was to coagulate the pus into a cheesy mass, which, when the parts were squeezed, came out of the various openings in the form of long worms. All this material was simply washed out with plain water and there was no longer any purulent secretion whatever, a clear fluid only appearing, and the sinuses and cavities healed very kindly and with great rapidity. The interior of the abscess cavity and sinuses, in short, says Dr. Veeder, was simply "tanned."]

Vesical catarrh is said to have yielded to daily injections of tannin, of a strength of 3 per cent., when other treatment had failed to cure. In *chronic urethritis* in men and in *elytritis* of *gonorrhœal* or other character, injections and douches have resulted in cure. For the former, the glycerite of tannin or a 10-per-cent. solution has been used; for the latter, a powder containing equal parts of alum and tannin is employed. A teaspoonful of this powder dissolved in a quart of water and used as a douche is equal to any other means of treating gonorrhœal elytritis, when combined with the other necessary hygienic and therapeutic measures. When tannin forms a part of the medicating agent of a douche for a pregnant woman, however, its percentage must be reduced, because of the possibility of evoking contractions in the muscular layers of the cervix. Actual abortion, it is true, has probably never been called forth by the drug; yet the individual susceptibility of gravid women varies so greatly that due caution should be observed. In ordering a douche of alum and tannin for a pregnant woman with gonorrhœa, the proportion of 1 part of tannin to 4 or 5 parts of alum is a safe one; or, if one's fear of cervical contraction should have a clinical foundation, the tannin may be omitted, despite its virtue in blennorrhagic elytritis. It is doubtful if the tannic-acid treatment of *acute gonorrhœal urethritis* in men should be recommended. Although it still has advocates, it has been unquestionably superseded.

Before plastic surgery on the genital organs of women had reached its present development, *prolapsus uteri*, *proctocele*, and *cystocele* were frequently treated by means of tampons soaked in a saturated solution of tannic acid, and good results were no doubt frequently obtained. Very often in these cases it is advisable to try douches of an astringent character before resorting to surgical measures, for by these innocuous means the symptoms may sometimes be relieved and an operation avoided.

Tannin has been praised in some affections of the skin in which a local astringent action is desired. Ringer advised its use, in the form of the glycerites, in cases of *eczema*. He asserts that a specially valuable result is obtained in the early stages of the disease, when the skin is red and swollen and exudation is free (*Practitioner*, i). He alleges that by its use the itching and burning are subdued and that the irritation of the skin by scratching is thus avoided. *Impetigo* and *intertrigo* are

said to have yielded to the use of tannic acid in an ointment. The drug is usually a component in preparations intended to allay *hyperidrosis of the hands and feet*, and it has been recommended, in a 1-per-cent. solution, in the treatment of *offensive axillary sweating*. Tannin has been used, in ointment form, for all *excoriations and abrasions* of the skin, particularly where they have been kept up by irritating discharges from neighbouring organs or lesions. It has also been recommended in the treatment of *chilblains*, and is probably as valuable as most other remedies used for the purpose.

Tannic acid has been used in the treatment of *burns* with good results, it is alleged, subduing pain and aiding in the formation of granulations. A solution of the acid in a strength of 1 to 4 in tincture of benzoin is said to prevent the formation of pustules in *variola*. As a *vermifuge*, tannin has some reputation in the treatment of *threadworms* in children. For this purpose it may be injected into the rectum in solution.

As a *styptic* by internal administration, tannic acid is widely known. It was first used as a hæmostatic agent in *menorrhagia* and subsequently in all forms of *uterine hæmorrhage* whether of functional or organic origin. It is to be recommended for these conditions only when they are not otherwise controllable. In *passive hæmorrhages from the stomach and intestines* its constricting and hæmostatic properties have been called upon to allay bleeding. Its use is favourably commented upon in cases of *hæmaturia*, even when this condition is dependent upon organic change. In the *hæmoptysis of pulmonary tuberculosis* its employment in a spray is sometimes of benefit, and in cases of *hæmophilia* tannin may be used when other hæmostatic agents do not accomplish the desired result.

As a *local hæmostatic*, as in the nose, in the rectum, or applied to bleeding varicose veins or to punctured wounds of any kind, it is valuable, though probably inferior to some other agents. It may be used in these instances in the form of styptic collodion or in a concentrated aqueous solution.

[Dr. Roswell Park, of Buffalo (*Medical News*, November 16, 1895), has called attention to a preparation made by mixing antipyrine and tannic acid in solution, by which there is precipitated an intensely agglutinative and cohesive substance which is the best styptic for certain purposes that he knows of. This combination he first resorted to in a case of apparently intractable hæmorrhage after the removal of adenoid tissue from the vault of the pharynx, to which he was called in consultation. The surgeon in attendance happened to have at hand a bottle of alcoholic solution of tannin, while Dr. Park was provided with antipyrine in powder. The case being urgent, he suggested the combination of the two styptics, and added the dry powder to the solution. To the surprise of both gentlemen, there was formed at once a gummy mass, at first flocculent, which quickly cohered, the result being a combination the adhesiveness of which quite astonished them. A small sponge dipped into the fluid containing this material in suspension was inserted into the post-nasal space, and the hæmorrhage was instantly checked, not to recur. Dr. Park has since experimented with these materials, and has found that they may be united in almost any proportion with the formation of the gummy mass. He suggests that the substances be mixed in proportion to the emergency of the case and to the desire for little or much of the resulting compound. It is possible, he says, by adding strong solutions, or by pouring the powder of one into the solution of the other, to precipitate so much of the agglutinative compound as to make a gum that may be placed about the margin of bleeding bone—for instance, in operations upon the cranium. Or a small piece of sponge or cotton sopped in this material may be forced into a tooth-socket, or in various other ways its use may be made to result in benefit and satisfaction. There is but one attendant difficulty—it is so remarkably cohesive that when the time comes for detachment or separation of the tampon it is difficult to remove it. It may be even necessary to wait a sufficient time for the formation of granulations and separation by natural processes.]

By *internal administration*, tannin is said to combat successfully cases of *atonic dyspepsia*. In *diarrhœas* in which no active inflammatory condition is present it is in frequent use, and usually is an element in the diarrhœa and cholera mixture sold in the shops. If the lesion is in the lower part of the intestinal tract, enemata of tannin are efficient in *chronic diarrhœas* and *dysentery*. It has been given internally for *night sweats*, *bronchitis*, and *phthisis*, although in the last-named disease its reputation rests purely upon theoretical grounds. The allegation once made for the drug that it diminished the albumin in *albuminuria* has not been substantiated by further investigation.

In bacteriological work, tannin mixed with sulphate of iron has been employed by Löffler for the staining of the flagella of typhoid fever and cholera bacilli. In the arts, as is well known, it is used to convert hide into leather.

During the epidemic of *cholera* in Italy in 1884 Dr. A. Cantani began the use of enteroclyses of tannin in the treatment of this disease. His procedure was to inject into the intestinal canal of all patients, severely or mildly ill, from 2 to 4 pints of a 1-per-cent. solution of tannin in boiled water. The temperature of the solution was from 100° to 104° F., and the fluid was allowed to run into the intestine gently from a height of from three to six feet. This procedure was repeated several times daily with results, according to the statistics of Cantani and others, that were decidedly encouraging. The enemata were begun, in the first series of cases, when stubborn vomiting which could not be controlled by opium had set in. Subsequently the enteroclyses were begun as soon as any symptoms of cholera manifested themselves, and in these cases, sometimes after one treatment, the diarrhœa and the vomiting ceased.

The advantages alleged by Cantani were based on bacteriological and clinical evidence. He found, in conjunction with other observers, that the exposure of pure cultures of cholera bacilli to a 1-per-cent. solution of tannin at a temperature of 102° F. for an hour and a half killed the bacilli and rendered subsequent inoculations of gelatin or bouillon from the culture experimented with sterile. A half-per-cent. solution of tannin accomplished the same result in six hours. Since tannin is innocuous to man, it therefore formed the most valuable antiseptic agent for use against the cholera bacilli. By employing the solution in the manner indicated, Cantani believes that frequently the ileo-cæcal valve is forced open and the diseased small intestine directly attacked. He maintains that the fluid reaches the small intestine, not only by the pressure it exerts, but by the antiperistaltic action evoked by the column of water. Further, he argues, the constriction of the mucous membrane determined by the tannin diminishes the absorption by the intestine of ptomaines and the other biological poisonous products of the bacilli present, at the same time emptying the intestine of its noxious contents. He modestly adds that, even if the enemata do not prevent the accumulation of toxic materials, at least they do not foster it. He lays stress, finally, upon the inability of the comma bacillus to thrive in an acid medium and gives the assurance that the return flow of the fluid invariably reddens blue litmus paper. By the employment of this method, after each defecation or diarrhœal stool, Cantani asserts, the mortality record is materially lowered; he adds that the earlier the treatment is begun the better are the results, that the heat of the solution and the absorption of fluid are beneficial to the patient in stimulating the heart, the lungs, and the nervous system, and that frequently patients so treated do not go into the algid stage. He maintains even that after the dreaded algidity has appeared life may be saved in some cases by the employment of the tannin enemata. He sometimes adds from 20 to 30 drops of laudanum to the solution injected, which may be made with infusion of chamomile instead of water. The rectal treatment should be accompanied by general stimulation and, when necessary, by subcutaneous or intravenous infusion of hot sterilized water (100° to 103° F.) containing in solution 3 per cent. of bicarbonate of sodium and 4 per cent. of chloride of sodium. Animal experimentation seems to bear out Cantani's belief that the function of the tannin is to form insoluble tannates with the toxic materials in the intestine. (*Die Ergebnisse der Cholera-Behandlung mittelst Hypodermoclyse und Enteroclyse während der Epidemie von 1884 in Italien*, von A. Cantani, Leipzig, 1886; Die Cholera-Behandlung, von A. Cantani, *Therapeutische Monatshefte*, June, 1888; *Berliner klinische Wochenschrift*, September 12, 1892.)

Von Generisch does not believe that the good results of Cantani's treatment resulted from the presence of tannic acid in the fluid used, but thinks that, with sufficient pressure, the ileo-cæcal valve can always be opened. He therefore proposes a modification of Cantani's method by passing into the rectum a large quantity of water from a height of from 2 to 4 feet. He asserts that after allowing from 15 to 20 pints to flow into the rectum, it will appear at the mouth, thus washing out the entire alimentary tract. Although this process of diaclysm (or diaclysis) is not attractive, the author asserts that the cleansing process is the main result desired. He employs tannin in a strength of 1 or 2 parts to 1,000, but believes that a salt solution or any indifferent fluid would be equally efficient (*Deutsche medicinische Wochenschrift*, 1893, No. 41).

Tannin may be administered in the form of pills, capsules, or troches. Its dose is from 3 to 10 grains. When given for hæmorrhage, it is best administered in aqueous solution, sweetened and flavoured, or in an emulsion. For external employment, a watery solution of from 3 to 10 grains to the ounce may be used. A solution containing 2 parts of tannin and 1 part of gallic acid is more astringent than one of tannin alone. As solutions of the iron (ferric) salts are precipitated by tannin, they must not be given at the same time.

Tannin bougies, *cereoli cum acido tannico*, are bougies 2½ inches in length, containing ¾ of a grain of tannic acid made up with syrup and gum arabic.

Collodium stypticum (U. S. Ph., Br. Ph.) contains 20 parts by weight of tannic acid, 5 of alcohol, 25 of ether, and of collodion a sufficient quantity to make 100. This is a modification of the original styptic colloid of the late Sir Benjamin Ward Richardson, of London, which did not contain sufficient tannin for the required purposes. Styptic collodion may be applied to shaded or wounded surfaces to prevent the admission of air. The ether and alcohol evaporate, leaving a stiff coating which, if the wound is aseptic, forms an excellent protective dressing. It may be applied with a camel's-hair brush or with cotton saturated with the solution. For special purposes, morphine, carbolic acid, or other antiseptic agents may be incorporated with it. For small, bleeding wounds or for ulcerated surfaces it forms a most efficient coating. It must be kept away from a flame, since the vapour of ether may take fire.

Glycerite, or glycerine, of tannin, *glyceritum acidi tannici* (U. S. Ph.), *glycerinum acidi tannici* (Br. Ph.), contains 20 parts of tannin and 80 of glycerin, and is prepared by heating the two substances over a water bath. It is the most valuable preparation of tannin for external use. It may be applied with benefit to *suppurating surfaces* of small extent and is of use in *chronic ozæna*, in *chronic otitis media*, and in *chronic relaxation of the pharyngeal vault*. It makes a good dressing for *irritating cutaneous eruptions*, and, applied to the nipples during the late months of pregnancy, will frequently prevent the development of *fissures of the nipples* during the nursing period. Internally, it may be administered for any of the purposes for which tannin is used, in doses of from 10 to 40 minims.

Suppositories of tannic acid, *suppositoria*

acidi tannici (Br. Ph.), contain each 3 grains of tannic acid and 12 grains of cacao butter. The *suppositoria acidi tannici cum sapone* (Br. Ph.), suppositories of tannic acid and soap, contain each 3 grains of tannic acid, 10 of glycerite of starch, 8 of curd soap in powder, and 7½ of starch powder. Although the amount of tannin is small for rectal use in an adult, the suppositories are used in cases of *fissure of the anus* and *prolapse of the rectum*. They are useful also in the treatment of *internal hæmorrhoids*.

Tannin troches, or lozenges, *trochisci acidi tannici* (U. S. Ph., Br. Ph.), are used in *relaxed conditions of the mucous membranes of the mouth, throat, and larynx*, and to allay *coughs* arising from these states. In mild cases of *angina* they may be employed, allowing them to dissolve slowly in the mouth. In *diarrhœas*, after washing out of the rectum, they may be administered for their astringent effect. The U. S. troches contain each about 1 grain of tannic acid, the British each ½ grain. The troches of the two pharmacopœias differ also in the vehicles and sweetening elements.

Ointment of tannic acid, *unguentum acidi tannici* (U. S. Ph.) contains 20 parts of tannin to 80 of benzoinated lard. It is very useful for local application in the treatment of *external* or *prolapsed hæmorrhoids*, sometimes producing a cure by causing contraction of these varicosities. Applied to *indolent ulcers*, it sometimes induces granulations.

Albuminate of tannin.—See TANNALBIN.

Aluminum tannate, *aluminii tannas*, has been recommended for its efficacy, in aqueous solution, in the treatment of *acute gonorrhœa*. The drug is not readily soluble in water, however, and cannot be recommended.

Bismuth tannate, *bismuthi tannas*, is a light-yellow powder, insoluble in water and tasteless. It contains 53 per cent. of bismuth oxide and 47 per cent. of tannin. It is astringent in its effect and has been employed in *diarrhœas, gonorrhœa, leucorrhœa*, and *purulent inflammations of the conjunctiva*.

Cannabene tannate is a yellowish-brown powder, insoluble in water and in ether, slightly soluble in alcohol. It has an odour which is not entirely unpleasant and a bitter taste. It is said to be the tannate of a glucoside. It is *hypnotic* in its effect, though not reliable. It is said to be devoid of the exciting effects of the extract of cannabis indica. The dose is from 4 to 20 grains.

Iron tannate, *ferri tannas*, is prepared by precipitating cold solutions of ferric salts with tannin. A mixture of ferrous salts and tannin, exposed to atmospheric influences, will also deposit ferric tannate. It occurs in a black or bluish-black powder which is easily decomposed by the mineral and the stronger organic acids. It has been used in *chlorosis* and *anæmia* in amounts of from 8 to 30 grains in a day in pill form. *Ink* is a watery solution of ferric gallotannate, and is popularly supposed to be a remedy for *ringworm*.

Mercury tannate, *hydrargyri tannas*, is odourless and tasteless and is insoluble in ordinary media. Acted upon by alcohol or water, however, it liberates tannic acid. It may be prepared by precipitating a concentrated solution of tannic acid and oxygenated mercurous nitrate, or by rubbing the two substances together. It was first suggested by Lustgarten as a substitute for other mercuric preparations in the treatment of syphilis (*Centralblatt für die gesammte Therapie*, ii; *New York Medical Journal*, March, 1892). Although it contains 50 per cent. of metallic mercury, it is alleged for it that its special advantage is that it is not affected by the acid juices of the stomach, but remains stable until it comes in contact with the alkaline secretions of the small intestine. Within twenty-four hours it appears in the urine as mercury and is absorbed from the intestine in minute globules of the metal. It does not salivate or cause gastro-intestinal disturbance. It may be given in doses of 3 grains thrice daily to an adult, increasing to 5 grains until from 100 to 150 grains are being taken.

Potassium tannate has been proposed as a substitute for the sodium salt, but it presents no special advantages and is rarely used.

Quinine tannate contains 40 per cent. of quinine. It is a very insoluble salt and has but from ⅛ to ⅙ the power of the sulphate. It is very slowly dissolved in the stomach and has little thermolytic influence. It is of value principally in *nervous affections* or as a substitute for the cinchona bark. Its tastelessness, or, rather, lack of bitterness, may be attributed to its difficulty of solution, and renders it suitable for administration to children in *malarial diseases*. The dose is three times that of the sulphate. It has been recommended for *whooping-cough*. Tablets made up with chocolate, each containing 1 grain of the drug, are in the market.

Sodium tannate, *sodii tannas*, is prepared by dissolving 75 grains of tannic acid in 5 oz. of water and saturating the solution with bicarbonate of sodium. It has been used in *albuminuria* in doses of ½ oz. given every two hours; but it not only failed to relieve the condition, but possibly caused death from uræmia (*Centralblatt für die gesammte Therapie*, i).

SAMUEL M. BRICKNER.

TANNIGEN, TANNIGENE, $C_{14}H_8(CH_3.CO)_2O_9$, is an acetic-acid ester of tannin in which two molecules, each, of three hydroxyl groups are replaced by one of acetyl. It occurs in the form of a yellowish-gray powder, without odour or taste. It is insoluble in cold water and in dilute acids, but dissolves freely in cold alcohol and in dilute alkaline solution. The experiments of Meyer, who first produced the drug, show that its influence on animals is not injurious. It produces no gastric disturbances, and is well tolerated even in large doses. Tannigene passes unchanged into the small intestine, where it is split up into tannic acid and acetate of potassium. It has been found as such in the fæces, so it is probable that the alkaline juices of the intestines do not break up all the tannigene ingested.

Escherich (*Therapeutische Wochenschrift*, March 9, 1896) finds that even when tannigene is excreted in the fæces some astringent effect is

exerted upon the intestinal mucous membrane. When there is increased secretion, however, and the intestinal juices are thoroughly alkaline, Escherich believes that tannigene is always split up into its elements and exerts an elective influence upon those places where the exudation is most intense—that is, where the disease is most marked. He finds its most useful application in cases where the lower part of the intestinal canal is affected by a non-acute inflammatory process, and alleges that nutrition and absorption are fostered by the diminished secretion of mucus. In the same article the author lays stress upon the disinfecting properties of tannigene and on the formation of insoluble compounds with alkaloids and toxines, as lending to its virtues.

The therapeutic indications for the use of tannigene include the *summer diarrhœa of children* and *subacute* and *chronic diarrhœas* occurring in the course of *pulmonary phthisis*, and *dysentery*. Some writers have professed to have treated successfully *acute enteritis* and *gastro-enteritis* with it, but the weight of evidence seems to be in favour of its employment in subacute and chronic intestinal disturbances. Tannigene is said to exert a beneficial influence upon the stools in subacute enteritis as early as the second day of its use; and in chronic diarrhœas, although it is not so rapidly effective, the fæces become formed and are free from mucus early in the treatment. Dietetic instructions must, of course, be simultaneously observed.

The good results from the use of tannigene do not seem to be confined to the intestinal mucous membrane. Cases have been reported of *gastro-enteritis* in which tannigene is said to have stopped the vomiting after one or two doses. The drug has also been employed in *hay fever* with alleged good results. It is said to be excellent, used as a snuff, in *acute* and *chronic coryza*. Insufflations of tannigene have been used in *acute otitis media*, and the antiseptic and astringent effect of the drug relieved the existing symptoms. Good results have been reported from the application of a 3-per-cent. solution of tannigene in a 5-per-cent. solution of phosphate of sodium in the treatment of *acute* and *chronic pharyngitis* and *laryngitis*. It is said that a disagreeable taste has followed its employment in these instances.

The dose of tannigene is from 3 to 10 grains, given from three to six times daily, the dose varying with the age of the patient. Escherich found it advantageous to give a large initial dose—15 grains to adults, and from 5 to 8 grains to children. It may be administered in milk or gruel, or taken dry on the tongue, followed by a drink of water. It may be combined with a salt of bismuth or with some other insoluble intestinal antiseptic if thought advisable. (See also ACETYLTANNIN.)—SAMUEL M. BRICKNER.

TANNIN.—See TANNIC ACID.

TANNOFORM is a condensation product of tannic acid and formaldehyde, of the formula $C_{29}H_{20}O_{18}$. It is a light reddish-white powder, insoluble in water and in acids, but dissolves in dilute alkalies. It is tasteless and odourless. Advantages have been alleged for it over tannic acid. It is said to have an indifferent action upon the gastric mucous membrane and to cause no irritation in the stomach, as sometimes happens when tannic acid is administered. Since acids do not dissolve tannoform, it is not assimilated by the stomach juices, but reaches the intestinal canal unchanged, where it can exert its action, which is said to be similar to that of tannic acid. Its advocates allege that tannin, on the contrary, is of harsh, astringent taste, and forms insoluble precipitates in the stomach with albumin, peptone, and gelatin, thus rendering it impossible for it to reach the intestines in an active form. They also maintain, what is not strictly true, that small doses of tannin corrode the gastric mucous membrane, diminish the appetite, and cause a sensation of weight and pain. These disagreeable effects are said to be absent after the use of tannoform. The new drug may be given in cases of *diarrhœa* and *dysentery*, for an *astringent* effect, in doses of from 5 to 15 grains three times daily.

Applied locally, tannoform, it is alleged, checks *excessive sweating*, and it has been used with good results in *hyperidrosis of the feet*. In this affection it is said to surpass in efficacy both tannic and salicylic acids. In the treatment of *old wounds*, *ulcers*, and *moist eruptions*, it may be used pure in a 10-per-cent. ointment, or mixed with equal parts of starch or chalk.

It has been used in a strength of 1 part to 4 parts of starch as a dusting powder for *soft chancres*, and is said to be useful in the treatment of *diabetic pruritus vulvæ*. As a snuff in *ozæna*, tannoform has also been recommended. (*Therapeutische Wochenschrift*, May 10, 1896.)—SAMUEL M. BRICKNER.

TANOSAL.—This is a synthetical tannic-acid ester of creosote, an amorphous, dark-brown, very hygroscopic powder having a faint odour of creosote. On account of its proneness to deliquesce, it can not be dispensed as a powder. It is on the market in the form of a watery solution of a definite strength and in that of pills. Each pill contains about 5 grains of tanosal, equivalent to 3 grains of creosote. On account of the ready solubility of tanosal, it is easily administered in water, and it is not irritating to sound mucous membranes; yet, because of its harsh taste, the solution should be freely diluted—a tablespoonful with half a glass of sweetened water.

Dr. G. Kestner, of the civil hospital in Mühlhausen (cited in the *Therapeutische Wochenschrift*, November 22, 1896), thinks that tanosal is better borne by the digestive organs than any other preparation of creosote. It seems to be excreted, he says, neither unchanged nor in the form of creosote. He has used it in more than seventy-five cases. The usual dose is a tablespoonful of the solution, three times a day, gradually increased in some cases to double that amount. There have been instances, he says, in which patients have taken as much as nine tablespoonfuls in a day with-

out any inconvenience. In three cases of tuberculous intestinal ulceration, however, the remedy gave rise to colic and diarrhœa, even in small doses. In many cases it became distasteful after being used for a long time, but generally the distaste was overcome.

Among the patients there were thirty-three with *pulmonary tuberculosis*, fifteen with *acute bronchitis*, eleven with *chronic bronchitis*, one with *chronic broncho-pneumonia*, five with *bronchitis incidental to infectious diseases*, and ten with simple *catarrh of the throat and bronchi*, and it was in the last-mentioned class of cases that the best results were obtained. Reduction of the bronchial secretion is the chief effect of tanosal, and to accomplish such reduction Kestner thinks it at least equal to terpene. Its action is the more pronounced the more recent the case, but even in cases of long standing it diminishes the expectoration and the dyspnœa. Children, he has found, respond to it more readily than adults, and for them the amount to be taken daily is commonly a teaspoonful of the solution for each year of age. In phthisical cases, he states, it acts as well as any other preparation of creosote.

TANSY, *Tanacetum vulgare*, is a perennial herbaceous plant indigenous to Europe, but naturalized in the United States. The parts used in medicine are the leaves and flowering tops. The herb grows to the height of from two to three feet. The leaves have a peculiar fragrance, and a bitter, slightly acrid, and aromatic taste.

Tansy has been employed in the treatment of *intermittent fever*, as a *diuretic* and *stimulant* in *rheumatism* and in *hysteria*, and the seeds are recommended as a powerful *anthelminthic*. The oil is also an effective *vermifuge*. The drug is perhaps best known from its domestic use as an *emmenagogue* and an *abortifacient*. Its action, however, either as a stimulant to the menstrual flow or as an ecbolic, is extremely uncertain, and grave symptoms have followed its administration. Death has resulted even from the ingestion of small doses—a drachm—of the oil, yet as much as four drachms have been taken without fatal effect. A case is reported in which a large quantity of the infusion, taken internally, produced death. The toxic effects are abdominal pain, vomiting, purging, paralysis of the muscles of deglutition and respiration, rapid and full pulse, convulsions, coma, asphyxia, and death.

The powder is given in doses of from 30 to 60 grains. The dose of the oil as an emmenagogue is from 1 to 3 drops. The infusion is made by steeping an ounce of the tops or leaves in a pint of water, and is given in quantities of 1 or 2 oz.—CHARLES JEWETT.

TAPIOCA is an amylaceous food obtained from *Manihot utilissima*, indigenous to Brazil, where it is known as the manioc plant. It is cultivated also in the West Indies, where it is known under the name of cassava. It is cultivated in other portions of tropical America and in Africa as well. It is perennial, and grows in the form of a bush, from six to eight feet in height. The roots are tubers of great size, sometimes weighing thirty pounds. From three to eight of these tubers grow in a cluster. They consist largely of starch, and are the edible part of the plant. Most varieties contain a bitter, acrid juice, which is intensely poisonous, owing to the presence of prussic acid. This is dissipated by washing, drying, and cooking. The starch obtained from the tubers is ground by the natives, dried, and again pulverized to form "cassava meal." The tapioca of commerce is made by heating the meal on hot plates and stirring it with an iron. As the starch granules burst, a portion of the starch is converted into dextrin, and the whole conglomerates into small irregular masses. The uncooked starch is sometimes imported into this country under the name of Brazilian arrowroot. Tapioca, like arrowroot, sago, and other forms of simple starch, is used largely as a food, and is well adapted to the needs of the sick. Like them, it has no medicinal properties.—FLOYD M. CRANDALL.

TAR is a highly complex product of the destructive distillation of organic substances and bituminous minerals, more particularly of certain woods and of coal. The commonest variety of wood tar, *pix liquida* (*q. v.*), is derived from conifers, especially *Pinus palustris* (in this country), *Pinus silvestris*, and *Larix sibirica* (in Europe). It is a thick, dark-coloured, viscid liquid, and has an acid reaction, a peculiar empyreumatic odour, and a bitter taste. It is produced by distillation *per descensum*. It may be described as an impure turpentine, containing, besides turpentine, as its most important constituents, various substances of the phenol group and pyroligneous acid. When it is subjected to redistillation in stills, the "oil of tar" is separated from the pitch.

Oil of tar, *oleum picis liquidæ*, is a volatile, oily liquid, which is more or less colourless at first, depending upon the amount of impurities it contains, but gradually becomes darker with age, from oxidation. It has a complex composition, containing oil of turpentine and acetic acid, with the phenols and most of the empyreumatic ingredients of crude tar, which it resembles in odour and in general properties. Like crude wood tar, the oil is soluble in alcohol, in ether, in chloroform, in volatile oils, and in solutions of caustic alkalis.

Oil of cade, oleum cadinum, oleum juniperi empyreumaticum, is an empyreumatic wood tar, obtained by distillation *per descensum* from the wood of *Juniperus oxycedrus* (Linn., Ord. *Coniferæ*), a tree found chiefly in lands bordering on the Mediterranean. It is thinner than common wood tar (*pix liquida*), black in mass, but brown or brownish yellow in thin layers. Its odour is pleasanter than that of the common tar, which, however, in most respects it resembles. Its taste is acrid and bitter. It contains a large proportion of acetic acid.

Oleum rusci is a tar obtained from the bark or other woody portions of *Betula alba*, chiefly in Poland and in adjacent parts of Russia proper. Birch tar has also been known as

"Russian oil," *oleum* seu *betulinum muscoviticum*. The origin of the term *oleum rusci* is obscure. It has been suggested by MacEwan that it is derived from the Polish *brzoza* (birch), which became corrupted and Latinized into *Bruscus* and *Ruscus*.

The mode of obtaining the birch tar has varied. At present it is said to be produced by distillation *per descensum*, as was most commonly the case in the past. All that is now in the market is said to be produced in this way. Formerly it was rectified by a second distillation. The rootlets and twigs were subjected to dry distillation in crude clay retorts connected by wooden pipes with a receiver buried in the ground. Such a rectified product, however, is rarely if ever obtainable at the present time.

It is a thick, brownish-black liquid, having the fragrant odour that we are familiar with in Russia leather. It is said to contain a larger amount of pyrocatechin than oil of cade, but less pyroligneous acid, though in its general properties it closely resembles oil of cade.

Beech tar, *oleum fagi*, is a wood tar similar to oleum rusci and oil of cade, and is the product of *Fagus silvatica*, or *Fagus silvestris*. It has been one of the chief sources of creosote. Though often mentioned by medical authorities abroad, especially German, commercially the name is said to have little significance, except as a synonym for wood tar, or as another name for oleum rusci. It is stated on good authority that real beech tar does not at the present time exist in the market. A beech oil obtained by expression from the fruit of the tree is occasionally met with, and is also known as *oleum fagi*. It is a bland oil of a yellow colour, has a slight odour and a mild taste, and resembles almond oil.

Coal tar, *pix liquida lithanthracis*, *pix liquida e liquo fossili*, is a semi-liquid, viscid substance, black in mass, greenish-black in thin layers, of a strong, penetrating odour, and but slightly acid or alkaline reaction. It is one of the by-products of the manufacture of illuminating gas from bituminous coal. Its composition is very complex, including carbolic acid in large quantity, together with rosolic acid; the alkaline bases ammonia, aniline, quinoline, and pyrrhol; the neutral hydrocarbons benzol, toluol, cresol, naphthol, naphthaline, chrysene, anthracene, cumene, and many others. The neutral substances constitute the greater portion of it.

In its physiological as well as in its therapeutical action, tar is closely allied to turpentine, though certain of its effects, due to the large amount of carbolic acid or other phenols which it contains, are peculiar to it. To insects and other low forms of life it is destructive, and *in large doses it is toxic* to the human organism. In moderate doses wood tar is an excitant, increasing the rapidity of the pulse and stimulating the secretions of the lungs, kidneys, and skin. If it is given in larger doses, the appetite is impaired, with more or less serious derangement of digestion, headache, and manifestations of general intoxication. These symptoms have been observed more particularly after the external use of the drug. When it is freely applied, absorption may take place in sufficient degree to give rise to alarming symptoms that correspond to those of carbolic-acid poisoning. Their onset may be sudden, and occur soon after the beginning of the treatment, sometimes following a single application when the surface to which it is made is extensive. The condition is characterized by fever, headache, loaded tongue, belching, nausea, vomiting of black tarry matter, colic, diarrhœa with tar-like evacuations, strangury, and ischuria, the urine becoming greenish, and finally black, emitting the characteristic odour of tar. After from twenty-four to forty-eight hours, if the applications have been suspended, the symptoms gradually abate, with copious diaphoresis and some diuresis. First the urine turns from black to olive-green, and becomes lighter and lighter in colour till the condition finally becomes normal. It is said that if the use of the remedy is afterwards resumed the patient becomes less intolerant of it, and no further trouble is experienced. Children and young persons are most susceptible.

When tar in a concentrated form is applied directly to a sensitive skin, it is apt to cause irritation with an eruption of a spreading erythema, or of inflammatory papules, which may assume a peculiar and very characteristic appearance. When the applications of tar have been extensive a follicular inflammation is apt to result, with occlusion of the sebaceous follicles by comedo-like plugs, composed of particles of tar. It is most likely to occur over the exterior surface of the lower extremities where the hairs are abundant. Hard and more or less painful papules form, varying in size from that of a pin head to that of a pea, of a reddish-brown colour, with a black point showing in the centre of each. They may be accompanied with the formation of nodules of larger size, or with furuncles. The affection is known as "tar acne," *acne picealis*.

Sometimes the internal use of tar is attended with the production of a cutaneous rash, which may be either erythematous, rubeolous, or urticarial in character.

In common with all balsamics, tar has a specific action on mucous tissue, whereby it becomes an effective *anticatarrhal agent*. In health, it tends to increase secretion, but where there is supersecretion due to a subacute or chronic inflammatory congestion, the secretion is diminished. In the *bronchorrhœa* of phthisis and other pulmonary affections it is often a useful remedy, and also in *chronic* or *subacute vesical*, *urethral*, and *vaginal catarrh*. The usual dose is from ½ a drachm to ½ oz. a day. It may be given in milk or beer, or in the form of pills or capsules. The glycerite is also a convenient and acceptable form of administration. Tar water, for the same purposes, may be given to the extent of from 1 to 2 pints a day.

The *vapour of tar* is used for inhalations in pulmonary troubles with excessive secretions, and also for deodorizing and purifying vessels and sick-rooms. The tar having been mixed with carbonate of potassium in the proportion

of 1 to 24, for the purpose of neutralizing the pyroligneous acid, which would irritate the lungs, is put into a cup which is placed in a small water bath over a spirit lamp. In this way the air of the room becomes gradually charged with the vapour. For the purpose of inhalation, the same effect may be accomplished more simply by letting the patient inhale the fumes of tar water or wine of tar by means of the steam atomizer.

In *diseases of the skin*, more particularly in those in which the mucous layer is specially implicated, tar is a much more effective remedy than it is in diseases of the mucous membrane proper. In *eczema* and *psoriasis* tarry applications are especially efficacious. Though some (notably Dr. McCall Anderson) have reported good results from the internal use of tar in these affections, all are agreed that the remedy is vastly more effective when applied directly to the diseased surface. In *eczema*, the rule is generally observed to await the decline of active inflammatory manifestations before beginning tar treatment. If it is begun earlier, while there is still vesiculation, surface exudation, or erosion, it is apt to aggravate the disease, resembling in this respect the treatment of catarrhal diseases generally by balsamics. It is well known, for example, that if the use of copaiba balsam, sandal-wood oil, and the like is begun while a gonorrhœa is in the acute stage, the effect is bad. These remedies are not appropriate till, with the decline of inflammation, the purulent discharge has given place to one that contains a considerable proportion of mucus. In eczema where the remedy is directly applied to the diseased parts, it is usually necessary to defer the use of tar till all discharge has ceased. Especially in eczema of an impetiginous character is tar objectionable. The indications for its use is generally regarded to be a condition of subacute inflammation manifested by a dry scaling surface with more or less hyperæmia and pruritus, inflammatory products still remaining in the tissues. Even at this stage it is not always well borne, the intolerance in some cases being apparently due to idiosyncrasy. It is therefore advisable to begin always with the milder preparations or with the tar in a diluted form, as in combination with an emollient ointment or with olive oil, or in weaker alcoholic or alkaline solutions. The weaker solutions of coal tar, made either from Dühring's compound tincture or from liquor carbonis detergens, often answer well. Later, stronger applications may be made. Instead of making the applications continuous, it is sometimes preferable to make them intermittent, as, for example, by means of the so-called "tar bath." This consists in first smearing the eczematous surface with tar or some of its preparations, afterward immersing the parts in a warm bath, washing off the tar with soap, and finally following with the application of some soothing and desiccating ointment like Lassar's paste (2 parts each of zinc oxide and powdered starch and 4 parts of vaseline). This method of using tar may be adopted with advantage even at an early stage of the disease and before the surface has ceased to exude. Lassar first recommended it for such early treatment. After the daily use of the tar baths for a few days an exuding surface often becomes dry, yellowish, and scaly, when it is possible to proceed to more continuous and energetic applications.

For *psoriasis* tar was formerly used much more than it is now. Latterly it has been largely superseded by chrysarobin. As employed by Hebra and others, the tar treatment was carried out very vigorously, and on this treatment the main reliance was placed. Two methods were employed—one continuous, the other interrupted or intermittent. In the former the patient was first subjected to daily friction with green soap (see under SOAP) or prolonged baths till the scales had been partly or wholly removed. Wood tar, preferably in the form of *oleum cadini* or *oleum rusci*, or some tarry preparation, such as *tinctura rusci*, was then well rubbed into the skin and allowed to dry on. To facilitate the drying, the patient was clothed in woollen or wrapped in woollen blankets, the advantage of which was that the wool did not absorb the tar as linen or cotton would. In from two to six hours, the surface having become quite dry, the patient resumed the usual clothing. The tarry inunctions were repeated once or twice a day, at each inunction the tar from the previous application being first washed off. This was continued till scales ceased to form.

For intermittent applications, the tar bath was used in the manner above described, except that each bath was preceded by green-soap frictions, and after the tar had been rubbed in the patient was made to remain in the bath for at least six hours. The tar that remained on the surface was then washed off with green soap, and finally the surface, having been dried, was dressed with a soothing ointment.

Formerly tar was much used as a remedy for *scabies*. Though it still is often employed as one of the ingredients of various "itch ointments," it is rather for the sake of its anticatarrhal effect than for the purpose of destroying the acarus.

As a *disinfectant* for *unclean or putrid sores*, the tar powders with gypsum or charcoal (more especially the coal-tar powder) are efficacious. Coal-tar powder was recommended by Devergie for *rupia*, *ecthyma*, *impetigo*, *herpes*, and *eczema*. An objection to the gypsum powders is their tendency to adhere and cake on the parts to which they are applied. With the recently manufactured disinfectant powders at hand, this preparation is seldom required.

Tar has a definite *anticnesmatic* action, chiefly owing to the carbolic acid or allied phenols which it contains, but partly, probably, because of its effect to reduce hyperæmia. This action is exhibited even in watery solutions. For *prickly heat* tar water is an excellent application, and also for *itching of the scalp*. The alkaline and alcoholic solutions as well as the coal-tar preparations with soap bark are especially serviceable for dry eczematous patches attended with itching.

The wood-tar preparations for internal use include *syrupus picis liquidæ*, of which the dose is from ½ to 1 fl. oz.; *glyceritum picis liquidæ*, of which the dose is from ½ to 1 fl. drachm; and *infusum picis liquidæ*, *aqua picis* (seu *picea*), tar water, of which the dose is from 2 to 4 fl. oz.

For external use, the prepartions of wood tar most commonly employed are the following: *Oleum picis liquidæ* (U. S. Ph.), *unguentum picis liquidæ* (U. S. Ph.), and *unguentum picis betulæ* (8 parts of birch tar to 42 of simple ointment).

Tar tinctures.—*Tinctura picis betulæ* may be made by dissolving 1 part of birch tar in 10 parts of alcohol, and afterward filtering. The formula for Hebra's *tinctura rusci* is the following:

℞ Birch tar..... 50 parts;
Sulphuric ether, } each.... 75 "
Alcohol, }
Oil of lavender..... 2 "

Mix the tar, ether, and alcohol, and filter; then add the oil of lavender.

Tinctura saponis cum pici consists of equal parts of wood tar, green soap, and alcohol.

The formula for Bulkley's *liquor picis alkalinus* is as follows:

℞ Tar..... 2 drachms;
Caustic potash..... 1 drachm;
Water..... 5 drachms.

The potash is first dissolved in the water and the solutions gradually added to the tar while rubbing in a mortar. For use it is to be diluted at first with 8 parts or more of water, gradually using stronger and stronger solutions.

For tar soaps see under SOAP.

Wood-tar powder is made by triturating 1 part of wood tar with 7 parts of gypsum.

The preparations of coal tar are suited only to external use. Because of its irritating qualities, this tar is never used internally. Its preparations include tinctures, emulsions with alkalies, and mixtures in the form of powder. The best alcoholic solutions of coal tar are made with tinctures of soap bark. The tincture of elm has also been used. The *coal-tar saponiné* of Lebœuf is made as follows:

℞ Coal tar..... 100 parts;
Tincture of quillaia..... 2,400 "

Mix and digest for six days in a closed vessel at a temperature of from 95° to 104° F. From time to time agitate the mixture and finally filter. Dühring's formula (*American Journal of the Medical Sciences*, May, 1894) is the following:

Digest 1 part of coal tar with 6 parts of soap-bark tincture (which should be of the strength of 1 to 4, and made with 95-per-cent. alcohol), with frequent agitation, for not less than eight days and preferably for a longer time, and finally filter. "It is a brown-black, clear tincture which upon the addition of water forms a clearly yellowish emulsion, the colour and certain other characters varying with the kind of coal tar employed." This preparation is called "compound tincture of coal tar," and is said to be very similar in its composition and therapeutic qualities to "*liquor carbonis detergens*," a proprietary article made by Wright & Co., of England, which is much used in Great Britain. For use as a wash, Dühring's tincture, as well as his liquor carbonis detergens, should be diluted with from 10 to 60 parts of water.

Emulsions of coal tar are made with strong solutions of caustic potash and soda or ammonia or with alcohol, but the tar separates when water is added, and is apt to cause irritation. The following preparation, in which alcohol and glycerin are associated with the alkali, is recommended by Dr. McCall Anderson:

℞ Coal tar..... 2 drachms;
Alcohol..... 2 oz.;
Stronger ammonia water. 8 minims;
Glycerin..... 6 drachms;
Distilled water, enough to make 12 oz.

Mix the tar and the alcohol, strain the mixture, and add the other ingredients. It forms an opaque, milky, dirty-brownish emulsion which may be further diluted with water in all proportions without precipitation.

A *coal-tar powder* (the *poudre de coal-tar* of the French) may be made with gypsum in the proportion of from 1 to 3 parts of the tar to 100 of gypsum. The tar is first heated till it liquefies in a pitch kettle, and is then thoroughly triturated with the gypsum. In place of the gypsum, powdered wood charcoal has been used.

The derivatives of coal tar, the so-called "coal-tar products," include many remedies of great value, especially among those of comparatively recent adoption, and it is to these that this tar owes its chief importance in medicine.—EDWARD BENNET BRONSON.

TARACANIN.—See under BLATTA.

TARAXACUM (U. S. Ph.), *taraxaci radix* (Br. Ph.), is the root of *Taraxacum officinale* gathered in autumn. It is the ordinary dandelion plant, common in fields, gardens, and meadows. Under the name *radix taraxaci cum herba*, the Ger. Ph. recognises both the root and the leaves. It is required to be free from the root of *Chicorium intybus*, or chicory, which it greatly resembles, the difference being that the chicory root is usually paler and more bitter, and has the milk vessels in radiating lines. The root of the plant is the most efficacious part. A sugar is frequently found in the juices of the roots gathered in the spring, *inulin* being more abundant when the plant is plucked between September and February.

An active principle, *taraxacin*, was isolated by Pollex in 1839. It is an amorphous, bitter, crystallizable mass obtained from the milk juice of the plant. It is somewhat acrid, fusible, and scarcely soluble in cold water, although very soluble in boiling water, in ether, and in alcohol. Kromayer obtained not only taraxacin, but also *taraxacerin*, $C_8H_{15}O$, which is insoluble in water, but is dissolved by alcohol. A resin and a fermentable sugar have also been found in the juice of the root.

The Arabs were the first to employ taraxa-

cum, using it as a deobstruent and blood purifier. During the eighteenth century it was widely used in chronic affections of the abdominal viscera, especially those of the liver. It was praised in the treatment of renal calculus and of some irritating diseases. Its popular reputation as a diuretic is seen in the vulgar English and French names of the plant. At the present day it has a limited employment as a *tonic* of slight power, as a *diuretic*, and as an *aperient*. It is said to act as a *stomachic* when there is diminished appetite, and it has been alleged for it that it promotes digestion. It has some reputation as an *hepatic stimulant*, although its powers in this direction are probably quite feeble, and it would require its prolonged administration to secure an increase of biliary secretion or a decrease of hepatic congestion. It has been used in *atonic dyspepsia* combined with *constipation* with reputed benefit. It has been praised even in the treatment of *pulmonary phthisis* on account of its supposed beneficial action on the stomach, liver, and intestines. The late Dr. George B. Wood, of Philadelphia, employed it with confidence in the treatment of *chronic congestion* and *inflammation of the liver and spleen* when there was no irritation or inflammatory condition of the gastric and intestinal mucous membranes. The dried root of taraxacum is sometimes mixed with ground coffee to be used in making a drink, and has sometimes been substituted for coffee after powdering and roasting.

Taraxacum, to be of any service, must be given continuously for several weeks, and will probably be of value only in cases of *hepatic torpor with constipation*. It may be administered in decoction, *decoctum taraxaci* (Br. Ph.), the dose of which is from 2 to 4 fl. oz., though this is apt to ferment. The dose of the extract, *extractum taraxaci* (U. S. Ph., Br. Ph., Ger. Ph.), is from 20 to 60 grains; that of the fluid, or liquid, extract, *extractum taraxaci fluidum* (U. S. Ph.), *extractum taraxaci liquidum* (Br. Ph.), is from 1 to 2 fl. drachms; that of the fresh juice, *succus taraxaci* (Br. Ph.), is from 2 to 4 fl. drachms.—SAMUEL M. BRICKNER.

TARTAR, CREAM OF.—Potassium bitartrate (see under POTASSIUM TARTRATES).

TARTAR EMETIC.—Antimony and potassium tartrate (see under ANTIMONY).

TARTARIC ACID, the *acidum tartaricum* of the pharmacopœias, belongs to the same group as citric acid, has essentially the same properties, although less agreeable, and may be substituted for it with entire propriety when the question of economy is of importance. It may be employed in making a substitute for lemonade, but is by itself rather flat and insipid, faults which, however, may be corrected by the addition of a few drops of essence or syrup of lemon, or of any fruit syrup which may be at hand. It may also be used in preparing extemporaneous effervescing mixtures, about 3 parts of the acid neutralizing 4 of sodium bicarbonate. An ordinary dose is 120 grains, although double that quantity can be used with safety.

The tartrates are soluble, as a rule, and those of the alkaline bases are cathartic, and generally mildly diuretic.

RUSSELL H. NEVINS.

TARTARLITHINE.—This is the name of an American proprietary preparation which is furnished in the form of effervescent tablets. It is described as "the lithium analogue of cream of tartar" (Coblentz), and appears to be a bitartrate of lithium. It is used in *gout*, also in *eczema* and other affections attributed to an *excess of uric acid in the blood*, in doses of from 5 to 10 grains (one or two tablets), in water, four times a day. Equal parts of tartarlithine and sulphur, also in the form of 5-grain tablets, to be taken in the same doses, are employed in the same diseased conditions, and particularly in cases associated with *torpor of the liver*.

TARTARUS BORAXATUS (Ger. Ph.).—This is a white powder, acid to the taste and in reaction, made by dissolving 2 parts of borax in 15 parts of water, with the aid of a vapour bath, and adding 5 parts of potassium bitartrate. It dissolves in its own weight of water. It is employed as a *laxative* in doses of from 1 to 2 oz. It has been supposed to be of service as a *lithontriptic*.

TARTARUS DEPURATUS (Ger. Ph.).—Potassium bitartrate (see under POTASSIUM TARTRATES).

TARTARUS NATRONATUS (Ger. Ph.).—Rochelle salt (see *Potassium and sodium tartrate*, under POTASSIUM TARTRATES).

TARTARUS STIBIATUS (Ger. Ph.).—Tartar emetic (see ANTIMONY).

TEA.—The plant which furnishes tea is the *Thea chinensis*, or *Camellia Thea*, an evergreen shrub which belongs to the natural order *Camelliaceæ*, indigenous to the southern part of Asia. It is extensively cultivated in China, Japan, and India, and to a lesser degree in South America, the United States, and elsewhere within 40° of the equator. In the United States its cultivation has not yet been attended by any marked success, possibly on account of the soil and climate, but quite as probably on account of lack of skill in the preparation of the leaves. The plant naturally becomes a small tree, which may attain to a height of thirty feet, but it is pruned when cultivated so as to prevent its growth upward more than from four to eight feet, and so cause it to become very bushy from a greater abundance of twigs and leaves. It was formerly described as of several species, but these are now considered to be varieties which have been produced by long cultivation, each of which possesses certain distinguishing characteristics. They are called *Thea bohea*, *Thea viridis*, *Thea stricta*, *Thea assamica*, etc. The India, Ceylon, and other teas are representatives of the same plant named from the countries in which they are cultivated, each of which presents certain characteristics of flavour, dependent mainly on the differences of soil and climate and possibly on variations in the manner of preparation. The most important division of tea is

into green and black, a distinction which does not depend on the variety of the plant from which the leaves are taken, but chiefly, if not entirely, on the method of their preparation. For example, the *Thea viridis* may be the variety cultivated in two districts of China, one of which produces green tea and the other black. At the same time, green and black teas are rarely if ever produced in the same district, and it is probable that different exposures, soils, and cultivation are influential in the most satisfactory production of each. The plants are propagated from seeds planted at certain distances from one another in rows. When they are three years old they yield the first crop of leaves for collection, and increase yearly in value until they are eight years of age, when they begin to deteriorate. At about this time they are frequently cut down, so that a larger product of leaves may be obtained from the numerous shoots which arise from the stump. The leaves are picked by hand during the rainy season, from two to four pickings usually being made at intervals of about six weeks. In China the first picking is made when the earliest buds are just opening into leaves. This first crop of buds and leaves form the very choicest quality of tea, very small quantities of which are ever seen in this country. It is largely purchased by the wealthy Chinese for home use, and it is difficult to export, because, when packed in large quantities, as in the great tea ships, it is quite apt to ferment. Considerable quantities are transported in small packages overland, principally to Russia, or sent with great care to other parts of the world. This grade of tea scarcely colours the water in which it is infused, although it is very strong to the taste.

The warm rains soon bring out more young leaves on the plants, and these are gathered during the second picking. At this time the best qualities for exportation are obtained, as the subsequent pickings supply only inferior grades of tea. The quality of the leaves depends upon a considerable variety of determining causes. Other things being equal, the quality varies with the time of picking; of the leaves picked from a plant at the same time, the smaller and more immature are of better quality than the larger, while the soil, situation, climate, attention to cultivation, and the character of the individual plant contribute severally toward the determination of the quality, and all unite to characterize numerous commercial varieties.

The descriptions of the method of preparing and drying the leaves vary a great deal as given by different writers, and it is probable that the details of the procedure are not the same in all places, but the following may perhaps be considered to give the essential differences in the manufacture of green and black tea, the most important of which is that the leaves intended to form black tea are allowed to undergo a certain amount of fermentation before they are dried. In the manufacture of black tea the leaves, after they have been plucked, are piled in heaps and left for several hours, frequently over night. They are then heated for a few minutes, then rolled and heated again. This alternate heating and rolling is repeated several times until the leaves are in a proper condition, and then they are dried slowly over a fire. The odour of these leaves is rather slight, and numerous grades are flavoured by the admixture of aromatic flowers for a day or so, after which they are removed by sifting or otherwise. In this manner the so-called English breakfast teas are prepared. When green tea is to be made, the leaves are not allowed to lie and ferment, but, within an hour or so after they have been gathered, are placed in pans and heated for four or five minutes over a brisk, smokeless fire. They are then removed, rolled by hand, and again placed in the drying pans over the fire, where they are kept in rapid motion for an hour or two. Colouring matters are frequently added to the leaves intended for the foreign market, particularly when they are of inferior quality. The principal chemical difference between green and black tea is that the green contains much more tannin, but the exact proportion is uncertain, as it varies to a considerable degree according to the analyses reported by different chemists.

The chemical constituents of tea are quite numerous, but the three most important ones are an alkaloid theine (see THEINE), an essential oil, and tannin. The essential oil is that which determines the flavour of the tea and probably assists materially in the production of its physiological effects. It is citron yellow, lighter than water, is solidified by cold and resinified by exposure to the air, and yields the characteristic odour of tea. It is not present in the fresh leaf, but develops during the process of roasting and drying.

The use of tea as a beverage has been common among the Chinese from a very early period, but among the occidental races it is essentially modern. It was introduced into England in 1657 at Garraway's coffee house, where it was received with great favour. At first the cost was excessive, but as the importation increased the price fell, until its use became general and supplanted that of sage tea, which had long been a favourite beverage. At the present time enormous quantities are consumed in all parts of the world, more perhaps by English-speaking peoples than by those of other European origin.

Writers on dietetics are accustomed to give explicit directions in regard to the preparation of the infusion, but it is to be feared that their rules are very frequently disregarded. To obtain the greatest benefit and enjoyment from a cup of tea, boiling water should be poured upon the leaves, allowed to stand in a closed and protected vessel for from three to eight minutes, and then poured off to be drank. In this manner the volatile oil, which determines the flavour and possesses to no slight degree stimulating properties, is preserved, while the undesirable extractive matters largely remain in the leaf. Prolonged steeping or boiling causes this volatile oil to be dissipated, while it draws out the tannin and other ex-

tractives which render the drink less palatable and more injurious to the digestive system. It is true that the finest young leaves contain proportionately less tannin than others and that on that account it is less objectionable to boil them, but no advantage, unless it may be the extraction of a larger amount of theine, can be obtained, while there is a very marked loss in the dissipation of the volatile oil. The inferior grades of tea are the ones most frequently boiled, and they make a dark, bitter, astringent decoction.

The action of tea upon the system is very complex. Liebig is quoted as stating that there are no drinks which, in their complexity, have more resemblance to soup than tea and coffee. The Chinese are said to consider it "cooling, peptic, exhilarating, stimulating, both laxative and astringent, diuretic, emmenagogue, and, in large concentrated doses, emetic." Some years ago Mr. E. Smith instituted a number of experiments from which he determined that tea caused an increase in the amount of carbon dioxide evolved in respiration as well as in the depth of inspiration. This would seem to indicate that it produces an increase in the waste of tissue, but the sustaining power it frequently exhibits would seem to denote the opposite effect, as it does not furnish any nutriment to replace the waste. Smith considers that it promotes assimilation and the transformation of foods. This may be true, although it retards artificial digestion. We know that it is a gentle stimulant to the nervous system, that it is refreshing, that it relieves the sensation of fatigue, and that it permits of increased exertion without food. The latter effect is so marked that some authorities, among whom is Captain Woodruff, of the United States Army, highly recommend tea for the use of soldiers on a march. After a considerable experience with it in arctic exploration, Dr. Hayes also warmly commended its sustaining power.

Other effects which are produced by tea are the promotion of cheerfulness and the stimulation of a lively flow of ideas, as well as the relief of *migraine* and *headache from overwork* or *worry*, and the production of insomnia. It has also a sedative effect upon the circulation and promotes the action of the skin. Although it is difficult, in regard to the latter effects, to distinguish between the results produced by the tea and those due to the introduction of the hot water in which it is infused into the system, we may with confidence ascribe a certain portion of the effect to the tea itself, and it is well known that after drinking a cup of tea the skin and mucous membranes are rendered moist, the perspiration is increased, and the temperature of the body is so regulated that it feels cooler in warm weather and warmer in cold.

In large quantities, tea precipitates the digestive ferments, retards digestion, and may occasion irritability and catarrh of the stomach. This is usually associated with constipation, but sometimes with diarrhœa with more or less flatulence. The nervous symptoms produced are, first, restlessness and insomnia, then muscular tremors, palpitation of the heart, and increased nervous worry.

It has been considered doubtful by some writers whether such a condition as *chronic tea intoxication*, or *theism*, exists or not. But these writers are very explicit in regard to how the infusion should be made and when drank, and if those rules are constantly and habitually violated, if large quantities of strong and boiled tea are drank at all times during the day, it is not a matter of surprise that the physiological effects on the nervous and digestive systems should be plainly apparent. It is a well-known fact, at least in the city of New York, that many women of the poorer classes keep a teapot on the stove from morning till night, and drink the bitter decoction at short intervals, adding fresh water to the stewed leaves from time to time and supplying more tea leaves as the strength begins to fail. These tea-drinkers are ill nourished, anæmic, dyspeptic, and morbidly nervous. Such conditions as these may possibly not be due entirely to the action of the tea, and they may be in part ascribed to the starvation induced, for persons who drink tea in this manner usually take very little nourishment; but the tea must be held primarily responsible for a large share of the toxic symptoms. The symptoms which have been ascribed to such an abuse of tea include anorexia, flatulent dyspepsia, sometimes nausea and vomiting, constipation, muscular tremor, irregular and feeble cardiac action, dyspnœa, nervousness, hysteria, headache, neuralgia, tinnitus, mental and physical exhaustion, nightmare, and hallucinations. Delirium is said to have been a result of chewing tea. Spratling has reported a very marked case of multiple neuritis caused by and dependent upon excessive tea-drinking, and this habit has been mentioned by some authorities as a contributing factor to the production of insanity. The appearance of such severe nervous manifestations may be properly ascribed to the idiosyncrasy of the individual, but their occasional occurrence furnishes a strong evidence that the minor nervous troubles commonly attributed to the consumption of large quantities of tea are caused by the tea itself. Professional tea-tasters are, as a class, very nervous and are said by some writers to be abnormally constipated and to have a diminished excretion of urea. It is frequently the impression that because tea-tasters simply rinse the mouth with the infusion none is swallowed, and whatever effect is produced upon them must be by absorption of the constituents through the buccal mucous membrane. As a matter of fact, a very few drops remain in the mouth after each taste and find their way eventually to the stomach, so that after a large number of tastings quite a quantity of tea has been drank, a very little at a time, and physiological effects may be expected. Sometimes the nervous symptoms which are induced in this manner are of sufficient severity to oblige a tea-taster to abandon his business, but so marked an effect is usually referable to idiosyncrasy.

The use of tea as a beverage should be

avoided in dyspepsia and in all irritable conditions of the stomach, as well as when there is a very marked tendency to constipation. But it is very useful to relieve the feeling of oppression which follows the ingestion of a very hearty meal. Persons who suffer from nervousness or insomnia should never drink tea, because it tends to increase these troubles. It is very frequently harmful when given to children.

For medicinal purposes a hot infusion of tea is occasionally useful for the purpose of causing diaphoresis at the commencement of slight attacks of *muscular rheumatism*, *bronchitis*, *amygdalitis*, or *pharyngitis*. It will also relieve *fatigue* and *muscular soreness after excessive exertion*, and so predispose to rest. In cases of *poisoning with narcotics* or with agents which cause *cardiac depression*, tea is a good antidote, though not so efficient as coffee. In these cases it should be given in large quantities and in a very concentrated form. It has been used as an injection in *leucorrhœa*, *gonorrhœa*, and *gleet*, as a collyrium in *conjunctivitis*, and as a gargle in *pharyngitis* and *amygdalitis*, but in all these affections its value depends on the tannin alone and not upon any of the constituents peculiar to itself, and usually more satisfactory solutions of tannin can be obtained for these purposes. One use, which is only too common, is to be seriously deprecated—the application of the stewed leaves as a poultice to an inflamed eye. It is very, very rarely that the application of a poultice to an eye is indicated, and much harm has resulted sometimes from such a procedure; moreover, when it is needed it is very easy to find materials better fitted for the purpose than tea leaves.

Lie tea.—For purposes of adulteration of tea, the dust and sweepings of tea warehouses are gathered together, cemented with rice water and gum, and rolled into grains which are coloured green and black. This mixture of refuse is very appropriately named lie tea, and can be detected on infusion when true tea leaves become unrolled, but the lie tea separates into its constituent parts.

Brick tea is another mixture of refuse, broken leaves, twigs, siftings, and sweepings, which are cemented together and moulded into forms. When it is to be used a piece is broken from the brick and infused like other tea. It is used to some extent in this country, and very largely by the Tartars, who reduce it to dust, infuse it, whip the infusion, powder it into a cream, and drink the whole. The same method of drinking powdered tea leaves in the infusion made from them is practised elsewhere, particularly in Asia.

MATTHIAS LANCKTON FOSTER.

TEABERRY.—See GAULTHERIA.

TEAS.—The word tea is in common use to denote infusions of certain plants, either for beverages or for medicinal purposes. It is not ordinarily considered to denote an official infusion or decoction, or other similar drink, as is the case with the French word *tisane*, but its use is rather restricted to infusions which are prepared and drank in the domestic rather than the professional practice of medicine, or as substitutes for tea and coffee. An exhaustive enumeration is impracticable, because most of these herb teas enjoy purely local repute, and in almost every locality certain ones are found in high esteem, so only a few examples will be given.

Teas may be divided into two classes, those used as beverages and those employed solely as medicines. Those of the first class have been to a great extent supplanted by tea and coffee, but the use of quite a number of other plants is occasionally met with, sometimes for purposes of adulteration, but for the most part upon their own merits.

First in importance possibly is *maté*, or *Paraguay tea*, which is made from the dried leaves of *Ilex paraguaiensis*, or Brazilian holly, a tree fifteen or twenty feet high, indigenous to South America. Other names by which it is known are *St. Bartholomew's tea* and *Jesuit's tea*, the latter name having been given to it because it is said that the early Jesuit missionaries in Brazil and Paraguay established plantations for the cultivation of the plant. For the *thé des Jésuites* of the Fr. Cod. see the paragraph on Mexican tea (page 269). The leaves are first heated to develop the aromatic principle, then dried over a fire, and finally powdered. The chief constituents are an astringent principle analogous to tannic acid, which is present in so large a quantity that the leaves are in demand for dyeing purposes, a volatile oil which determines the flavour, and an alkaloid isomeric if not identical with theine. The infusion is *sudorific*, *diuretic*, a *stomachic irritant*, and, in large doses, *emetic* and *purgative*. It powerfully influences the nutritive functions, and in its effects shows a closer resemblance to coca than to tea. It is drank in large quantities by the natives of those parts of South America where the plant abounds and is much prized by those who have learned to enjoy its peculiar flavour. When taken in excessive quantities it is said to produce a kind of delirium tremens.

Brazilian tea is almost the same as the preceding. It is made from the leaves of *Ilex gongonha* and *Ilex thœzans*. The preparation of the leaves and the use and effect of the infusion are very closely similar to those of Paraguay tea.

In Sumatra and other islands of the East Indian Archipelago *coffee leaves* are dried, powdered, and used after the manner of tea. It has, indeed, been called *coffee tea*. The leaves possess properties analogous to those of the fruit, and were found by Dr. Stenhouse to contain a larger proportion of caffeine. The infusion resembles in taste and odour one made from a mixture of tea and coffee, and is said to approach the most nearly to tea of any of its substitutes.

Abyssinian tea is made from the dried leaves of *Catha edulis*, a plant which is cultivated in northern Africa. The use of the infusion is extensively practised as a beverage in Arabia as well as in Africa, where it is known as "chaat." Dr. Paul failed to obtain an alkaloid

from the leaves, and their composition is practically unknown.

Bush tea and *Hōnig tea* are made from the leaves of certain species of *Cyclopia*, and are used as substitutes for tea at the Cape of Good Hope. The leaves are said to contain an alkaloid called cyclopine, which differs from theine.

New Jersey tea is made from the dried leaves of *Ceanothus americanus*, or red root, a shrub of the *Rhamnaceæ*. It has been pronounced "a good substitute for indifferent black tea." During the American Revolution, and also in the Southern States during the War of the Rebellion, this was used considerably as a substitute for tea when the latter was not to be obtained. Little is known of its constituents except that it contains tannin, a resin, and a volatile oil. It has some repute as an alterative, is said to be purgative, and has been recommended in dysentery and as a local application in sore throat.

Labrador tea is also said to have been used as a substitute for tea by the patriots during the American Revolution. It is made from the leaves of *Ledum latifolium*, an evergreen shrub indigenous to the northern part of the United States and to Canada. They have an agreeable odour and taste, while the infusion is strong in astringent and narcotic properties.

Marsh tea is made from *Ledum palustre*, a congener of the preceding, found in the northern part of Europe, Asia, and America. The leaves have a balsamic odour and an aromatic, bitter taste, and are said to have been substituted for hops in the manufacture of beer in Germany. They are sometimes used, in the form of a decoction, in the *exanthemata*, in various *skin diseases*, and to allay irritation in *whooping-cough*.

It is not an infrequent occurrence for the same name to be applied in different places to two or more substances quite distinct in their nature. *Mexican tea* may be mentioned as an example, as this name is applied to the infusion of the dried leaves of *Psoralea glandulosa*, which resembles Paraguay tea, and also to that made from *Chenopodium ambrosioides*, which is an anthelminthic and also used for various nervous derangements. The latter is known in the Fr. Cod. as *thé des Jésuites*, and as *té de España* among the Spaniards, and will serve here to introduce the second class of teas, the medicinal.

Oswego tea, *spearmint tea*, and *peppermint tea* are all made from various species of mint, and are much esteemed as *stimulant carminatives*.

Catnip tea, made from the leaves and tops of *Nepeta cataria*, bears a close resemblance to the mint teas, but has the reputation of being also *antispasmodic* and *emmenagogue*. Although it is not used to any great extent by the medical profession, it is employed as a domestic remedy in *amenorrhœa*, *chlorosis*, and *anæmia*, as well as for its carminative action.

Boneset, or *thoroughwort*, *tea* is an infusion of the leaves and tops of *Eupatorium perfoliatum*, a plant indigenous to the United States. When taken warm, it is a popular *diaphoretic* in *fevers* and for the purpose of aborting a *cold*. In the form of a warm, strong decoction it is an efficient *emetic*. When cold, the infusion is used with advantage in *dyspepsia*, *general debility*, and other conditions in which a bitter tonic is indicated. It has also been used as a *tæniacide*. The name "boneset" was given to this tea on account of its supposed power to relieve the *bone pains in dengue* or "*breakbone fever*." (See EUPATORIUM.)

Saffron tea is an infusion of the flowers of *Carthamus tinctorius* which enjoys some repute as a *diaphoretic* in *measles* and other *exanthemata*.

Elderberry tea is made from the berries of several indigenous species of *Sambucus*, and is used as an *aperient* and *diaphoretic*.

Tansy tea is made from the leaves and tops of *Tanacetum vulgare*, a perennial, herbaceous plant indigenous to Europe, but also cultivated and growing wild in this country. It is very widely known as an *emmenagogue*, a *diuretic*, an *anthelminthic*, an *aromatic bitter*, and an *irritant narcotic*. Although it is useful in *amenorrhœa*, it has no rightful title to its widespread repute as an abortifacient. Death has resulted in several instances when very large doses have been taken for the purpose of causing abortion, without this effect having been produced.

Linseed, or *flaxseed*, *tea* is a *demulcent* drink made by the infusion of the whole seeds of *Linum usitatissimum* in water in the proportion of half an ounce to a pint. The mucilage present is thus extracted with only a small quantity of the oil, and thus a tea is made which may be advantageously employed in *inflammations of the respiratory*, *gastro-intestinal*, and *urinary mucous membranes*. It is useful in *dysentery*, to relieve *strangury*, *cystitis*, and *renal colic*, and to allay *cough*. When the seeds are boiled, more of the oily matter is extracted which renders the decoction less fit to be given by the mouth, but useful as a *laxative enema*.

German "breast tea," or *marshmallow tea*, is another *demulcent* drink which is made from the root of *Althæa officinalis*, and is official in the German Pharmacopœia as compound althæa tea. It is much used in *coughs*, *colds*, and *bronchial affections*. Occasionally the roots of other species of the *Malvaceæ* are substituted for the marshmallow, without disadvantage, as they all possess similar qualities.

Worm tea is a popular *anthelminthic* for the *roundworm*, *Ascaris lumbricoides*. It is also known as the compound infusion of spigelia, and is composed of spigelia, senna, fennel, manna, and savine, infused in water, but the proportions in which these drugs are used is not always the same.

Garfield tea and *Hamburg tea* are two proprietary preparations which have been widely advertised, but hardly deserve notice. Garfield tea is said to consist chiefly of senna leaves and couch grass with aromatics, while Hamburg tea is a mixture of senna, manna, and coriander.—MATTHIAS LANCKTON FOSTER.

TEEL OIL.—See SESAME OIL.

TENTS, sometimes employed in gynæcological practice, are pencils of compressed sponge

or other material capable of expanding on the absorption of moisture. They were formerly much used for dilating the cervical canal of the uterus. Besides sponge, cornstalk, slippery-elm bark, the stem of *Laminaria digitata*, and the root of *Nyssa aquatica* (tupelo) have been utilized for making tents. Of these materials, sponge, laminaria, and tupelo are most employed.

Sponge tents are made from fine grained surgical sponges of small size. These are cleansed and disinfected, and are then subjected to pressure, either by winding them with twine or by some mechanical device until they are reduced to the size of the finger. They are allowed to dry and then are trimmed to the shape of a slender cylinder or cone 2½ inches long and ¼ inch or less in diameter. Sponge tents are effectual dilators, but are particularly objectionable from the standpoint of asepsis. Used in the cervical canal, they abrade the mucous surfaces, soften the tissues, and sink into the cervical folds. On the removal of the tent, fragments of the sponge are liable to be left behind. Sometimes the tent is found quite offensive when it is removed. The patient is thus exposed to septic infection, notwithstanding the utmost antiseptic precaution. Usually two or three tents have to be used in succession to effect the required dilatation.

Laminaria tents are made of the stalk of *Laminaria digitata* turned into smooth pencils. Their dilating power is little inferior to that of sponge, but they are apt to expand unequally, leaving a constricted zone at the os internum, and are therefore withdrawn with difficulty. The point of constriction, too, where the dilatation fails, is the one where dilatation is most needed.

Tupelo tents possess great and equable expansile power and dilate more gently than laminaria. A tupelo tent expands to two or three times the diameter it had in the dry state, it is smoother than sponge, and it does less injury to the cervical tissues. Tupelo is therefore the most suitable material for tents if they are to be used for dilating the uterus.

Both laminaria and tupelo are open to the same objections that obtain in the case of sponge, though in less degree. It is practically impossible to maintain, even for a few hours, an aseptic condition of the cervical canal, even though it be primarily sterile to culture tests. Dilatation of the uterus with tents is always attended with danger, and the plan has fallen into disuse, except for cases in which the rigidity of the cervical tissues is so great as to resist the action of the steel dilators.

Tents, if used at all, must first be sterilized and the passages prepared as carefully as for a surgical operation. A convenient and effectual method of sterilizing the tent is by exposure for several hours in a corked phial to a temperature of about 302° F. The vagina and the immediate external surroundings are to be thoroughly scrubbed with soap and hot water. The cervical canal is cleansed of mucus with a curette and repeatedly wiped out with a cotton-wrapped probe dipped in the mercurial solution. The cervix and vagina are subjected to a prolonged douching with a 1-to-2,000 bichloride-of-mercury solution, the parts being scrubbed with a swab of sterile cheese cloth during the irrigation. The cleansing of the cervical canal may be completed by introducing for a few moments a cotton-wrapped probe dipped into a mixture of equal parts of glycerin and carbolic acid or some other equally powerful antiseptic.

To introduce the tent, the patient is placed in the Sims posture, and the cervix brought into view with the aid of a Sims speculum. The cervix is drawn gently forward and steadied with a volsella caught in the anterior lip. The phial containing the tent is now uncorked, the tent seized with sterile dressing forceps and passed its entire length into the cervical canal. Sometimes several small tents are better than a single large one. As an additional precaution against sepsis, the tent, immediately before its insertion, may be wet with the antiseptic solution and dipped in sterilized iodoform powder till it is well coated with it. The tupelo tent, which is much the best of the varieties mentioned, is apt to slip out of the canal if left unsupported. A vaginal tampon of iodoform gauze should therefore be placed underneath it. A tent ought not be left in the cervix more than from eight to twelve or twenty hours, and it must never be followed immediately by another. The rapidity of dilatation is greatly increased if the vagina is douched after introducing the tent into the cervix and the upper portion of the tamponade is well wet with the antiseptic solution. The patient must remain in bed until the tent is removed.

A kind of tent occasionally employed in general surgical practice differs somewhat from the foregoing. These tents are used merely to keep wounds or fistulous tracts open. They consist of small masses of gauze, wicking, or similar material rolled or twisted into cylindrical or conical shapes and inserted into the fistula or between the lips of the wound. The object is to maintain drainage.—CHARLES JEWETT.

TEREBENE, *terebenum* (U. S. Ph.), is a clear, colourless or slightly yellowish, thin fluid. It is produced by the action of sulphuric acid upon the oil of turpentine. The acid must be gradually added to the cooled oil of turpentine, 1 part of acid to 20 parts of oil. The mixture is boiled after twenty-four hours' standing, and, upon cooling, the oily layer is removed after freeing it from acid, and is rectified. Terebene has an agreeable, aromatic odour, something like that of freshly cut pine, and its taste is very similar to that of turpentine. It is isomeric with turpentine, having the formula $C_{10}H_{16}$. It dissolves very slightly in water, but is soluble in equal volumes of alcohol, glacial acetic acid, and carbon disulphide. It boils at 150° to 160° F. Exposed to the light, terebene gradually becomes resinous and, at the same time, acid. The U. S. Ph. requires that terebene shall not redden blue litmus paper and shall have but a very slight action on polarized light. On evapora-

tion, it should not leave more than a very slight residue, indicating a mere trace of resinous matter. Terebene has a specific gravity of 0·862 at a temperature of 59° F.

Terebene was first brought to the attention of the profession in 1873 by Ribau, of Paris, but it was many years before it received general notice. Even since it came into quite common use its physiological properties have been but little investigated. It is likely that in its effects upon the general system it resembles its isomer, turpentine. Occasionally its continued ingestion has been known to give rise to pain in the lumbar region, and sometimes diarrhœa has appeared after its use. Wimmer has called attention to an occasional hæmaturia, indicating renal congestion, and to an apparent difficulty in passing urine after the administration of terebene. He concludes therefore that it is contra-indicated in the presence of kidney disease. All the symptoms enumerated disappeared upon the withdrawal of the drug (*New York Medical Journal*, February 9, 1889). No records of poisoning by terebene are to be found in literature, and it is probable that only in exceptional cases in which some idiosyncrasy exists are toxic symptoms likely to be evoked.

Dr. William Murrell, of London, was the first to direct attention to the therapeutic value of terebene (*British Medical Journal*, December 12, 1885). He recommended it for the so-called "*winter cough*" of *chronic bronchitis*, and reported in his first paper many cures. He praised the remedy not only for its curative effects but because of its advantages also. Its ease of administration, its agreeable taste and odour, and its lack of bulk appealed to him as ideal virtues for a remedy. He employed terebene—as it is still frequently employed—in increasing doses, from 5 to 6 drops every four hours to 20 drops at the same intervals, taken on a lump of sugar or on granulated sugar. Murrell had great success with this therapeutic measure, and its use for pulmonary disturbances rapidly became general. Murrell further stated that terebene possessed little or no toxic action, but remarked that its use endowed the urine with a peculiar odour. He found that terebene acted well not only in winter cough, but also when *emphysema* complicated the chronic bronchitis. He alleged that in *phthisis*, when there was old consolidation with no active process going on, its employment was of benefit, and believed that it might prevent the occurrence of a *hæmoptysis*. Murrell also found that when there were *flatulence* and *hyperacidity* present in addition to the cough, these were also alleviated. He had good results, too, in the employment of terebene as a spray in the mouth and nostrils. He concluded, as is now generally accepted, that terebene is an excellent *expectorant*, possessing at the same time considerable *stimulating* power.

Terebene may be employed in *acute bronchitis* after the earlier stages have been passed, as an expectorant and stimulant. It is efficacious in *clearing the larynx* for singing and speaking. It has been recommended in *asthma*, *emphysema*, *phthisis*, *pleurisy*, and *pleuropneumonia*. In cases of *pleuritic adhesions* its employment is said to hasten the absorption of the exudate. In *fœtid bronchitis* and *bronchiectasis* its administration is said to be as efficacious as that of turpentine. Barton praised its use in small doses in *chronic rhinitis*, alleging that the discharge ceased, the nasal passages became clear, and the headache disappeared. Terebene is employed with alleged good results in *flatulence* and in *subacute inflammations of the genito-urinary tract*. Its alleged diuretic action has not been clinically proved. Murrell has found that terebene has active antiseptic properties, being able to check the action of the yeast plant in a solution of 1 part to 450, and in a solution of a strength of 1 to 500 to hinder the development of bacteria. It is also known that the activity of vaccine virus is destroyed on contact with terebene. Practically, this antiseptic influence has been made use of by substituting terebene for carbolic acid in the dressing of *wounds*, *ulcers*, and *burns*, and, it is stated, with success. It has a considerable deodorizing power, and thus destroys the odour of secretions while protecting the surface to which it is applied from contact with atmospheric air. Locally, it may be applied pure or in a strength of 1 to 6 in olive oil. Tampons soaked in terebene have been applied to *sloughing carcinomata of the cervix uteri* for antiseptic and deodorizing purposes. Whether its activity in these respects is due to a certain amount of untransformed turpentine, as is alleged by Bond (*British Medical Journal*, December 19, 1885), or to the supposed presence of hydrogen dioxide, as believed by Cammann (*Transactions of the American Climatological Association*, 1888, p. 163), has not been determined.

Terebene may be administered on sugar, although it is likely that an insoluble mass may result from this method. It may be given in emulsion or in capsules or by atomization, as recommended by Murrell. It may be emulsified by adding to it equal parts of olive oil and emulsifying with acacia or tragacanth. A good prescription is the following (Wimmer, *loc. cit.*):

℞ Terebene..... 10–15 minims;
Spirit of chloroform... 10 drops;
Mucilage of tragacanth. 1 drachm;
Simple syrup..... ½ drachm;
Distilled water, enough to make 1 oz.
M. S.: For one dose.

The dose of terebene is from 3 to 15 minims, repeated every four hours. An adult may take a drachm in divided doses in twenty-four hours.—Samuel M. Brickner.

TEREBINTHINA.—See Turpentine.

TERPIN HYDRATE, *terpini hydras* (U. S. Ph.), *terpinum hydratum* (Ger. Ph.), is the hydrate of the diatomic alcohol terpin. Its formula is $C_{10}H_{18}(OH)_2.H_2O$, and it has a molecular weight of 189·58. It occurs in colourless, rhombic, quite lustrous prisms. It is almost entirely odourless, and has a slightly aromatic yet somewhat bitter taste. It is per-

manent in the air. Terpin hydrate is soluble in about 250 parts of water at 59° F. It is dissolved in 10 parts of alcohol at the same temperature, and in boiling water and alcohol in lesser quantities. Ether, chloroform, and boiling glacial acetic acid also dissolve terpin hydrate in the respective proportions of 100, 200, and 1. "At 496·4° F. anhydrous terpin distils over without decomposition, soon solidifying to a crystalline, hygroscopic mass which melts at 215·6° to 221° F. When strongly heated on platinum, it burns with a bright, smoky flame, leaving no residue. . . . Terpin hydrate should not have the odour of turpentine, and its hot, aqueous solution should not redden blue litmus paper (absence of *adhering acid*)." U. S. Ph.

Lepine first investigated, in 1883, the physiological action of terpin hydrate and found that its influence upon the mucous membranes and nervous system was similar to that of turpentine. Because of its action on the kidneys he recommended its employment in *chronic nephritis;* and because of its sedative and stimulating influence upon the bronchial mucous membranes, he urged its use in *chronic bronchitis.* These observations were confirmed subsequently by clinicians, and terpin hydrate is much used to-day in these disorders and in the advanced stages of *acute bronchitis,* especially when the expectoration and secretion are very free. It has been employed in *chronic cystitis* and in *gonorrhœa* with alleged good results. Terpin hydrate imparts the characteristic odour of turpentine to the renal secretion, and, given in too large or too long continued doses, it may evoke strangury, albuminuria, or even hæmaturia. Its influence, therefore, may be very irritating to mucous membranes if it is given in overdoses.

Penzoldt cordially commends the employment of terpin hydrate in *chronic disease* of *the heart* and *kidneys,* particularly in *chronic diffuse nephritis,* accompanied by degenerative changes in the heart muscle, with albuminuria and widespread œdema. He has met with congestion of the kidneys, however, after its use, as indicated by hæmaturia, and cautions against its careless or promiscuous employment (*Lehrbuch der klinische Arzeneibehandlung,* 1889). The drug has also been praised in the treatment of *whooping-cough* and *hay fever* and has been recommended to prevent the formation of *flatus* and assist its expulsion.

Terpin hydrate may be given in doses of from 1 to 3 grains, from four to six times daily, in pill, emulsion, or lozenge.

SAMUEL M. BRICKNER.

TERPINOL is a mixture of terpenes with varying properties and the alcohol terpineol, $C_{10}H_{17}OH$. It is a colourless, oily substance, and is prepared by boiling terpin with diluted mineral acids. It emits an odour like that of hyacinths. It is insoluble in water, but dissolves readily in alcohol and in ether.

It is said to be efficient in *respiratory diseases* and to have little or no effect upon the kidneys and nervous system, being eliminated almost entirely by the lungs. It is employed in *chronic bronchitis* as an *expectorant* when the cough irritates the bronchial mucous membrane.

Terpinol may be given in doses of from 3 to 5 grains, from four to six times a day, in capsules or in pill form.—SAMUEL M. BRICKNER.

TESTA PRÆPARATA.—This is a preparation made by freeing oyster shells from all extraneous matter and reducing them to a fine powder. It is used as an *antacid,* in doses of from 10 to 40 grains, frequently repeated, in *acid dyspepsia* and *diarrhœa.*

TESTICLE JUICE, TESTICULAR LIQUID.—See under ANIMAL EXTRACTS AND JUICES (vol. i, page 73).

TETANUS ANTITOXINE.—See under ANIMAL EXTRACTS AND JUICES (vol. i, page 84).

TETRAETHYLAMMONIUM. — See TETRETHYLAMMONIUM.

TETRAHYDROBETANAPHTHYLAMINE.—See THERMINE.

TETRAHYDROPARAQUINANISOL.—See THALLINE.

TETRAIODOPYRRHOL.—See IODOL.

TETRAIODPHENOLPHTHALEIN.—See NOSOPHENE.

TETRETHYLAMMONIUM.—Hofmann (*Annalen der Chemie,* lxxviii) obtained this substance by decomposing its iodide with moist silver nitrate or its sulphate with baryta. It occurs in deliquescent hairlike needles. It absorbs carbon dioxide from the air. It is strongly alkaline, saponifying fats. Concentrated, it burns the tongue. It is as bitter as quinine. It has a caustic action upon the epidermis and an unctuous, alkaline feel when rubbed between the fingers. Its formula, or rather that of its hydroxide, is $(C_2H_5)_4N.OH$. It is not decomposed by the galvanic current. It forms numerous salts (sulphate, nitrate, phosphate, carbonate, hydrochloride, hydrobromide, iodide, and bromide), and beautiful double salts with platinum, gold, mercury, etc.

The drug was first used medicinally by the undersigned (see *New York Medical Journal,* September 16, 1893). With Mr. Thomas A. Edison I sought the best solvent for uric acid, in order to make use of it with electricity (cataphoretically) in gouty and rheumatic joints. We prepared several hundred of the small glass phials, each holding about two cubic centimetres of different liquid solvents, corked and labelled. Into each was dropped a small quantity of powdered uric acid as obtained chemically pure from Germany, and then we filled up the phials each with one solution. After shaking them up they were set aside for periodical examination. Only two of these phials showed that the uric acid had dissolved —that is, with anything like readiness. The two effective solutions were that of neurine and that of tetrethylammonium. On repetition, these were found to dissolve uric acid quite freely. I compared the relative values of tetrethylammonium and piperazine, and found that the former was much more effective than the latter as a *solvent for urea, uric acid,*

and the like. I employed 10-per-cent. solutions of each for the experiments. Urate of sodium removed from the knee of a patient dissolved readily in both neurine and tetrethylammonium. It seems that both neurine and tetrethylammonium are normal constituents of the bodies of animals, and it may be that the diseases in which urates are produced and accumulate in the system are due to a deficiency of what seem to be normal elements of our structures.

It was first tried on rabbits, to establish the dose, and then in some cases of *acute* and *chronic rheumatism*. In these patients it had beneficial effects, though doubtless its chief use would be in cases with *uric-acid calculi* and allied conditions. It is important to bear in mind that tetra*methyl*ammonium is poisonous, giving rise to symptoms similar to those produced by curare, whereas tetrethylammonium may be employed with safety.

The doses that may be safely used by the mouth are from 10 to 20 minims of a 10-per-cent. solution three times a day. Hypodermically, it would be better to have a 1-per-cent. solution and to inject not more than 10 minims of this until one was assured that no deleterious effect upon the tissues was produced.

It may prove especially useful in the place of solutions of lithium salts when applied on positive galvanic electrodes about *gouty joints* or *rheumatic tophi*. The 1-per-cent. solution may be used for cataphoretic purposes.

FREDERICK PETERSON.

TETRONAL is a *hypnotic* of the disulphone group, the difference between it and trional being that it contains four ethyl molecules, while trional contains but three. Its formula is $(C_2H_5)_2.C(SO_2C_2H_5)_2$, diethylsulphondiethylmethane. It is produced by oxidizing diethylketonemercaptol, $(C_2H_5)_2.C(SC_2H_5)_2$, with potassium permanganate after substituting diethylketone, $(C_2H_5)_2CO_2$, for acetone, (C_3H_6O), during the manufacture of sulphonal. Tetronal occurs in colourless, shining plates and laminæ. It is soluble in 450 parts of cold water, in alcohol, and in ether, and has a neutral reaction. Its melting point is 192·2° F. Its solutions are odourless and tasteless.

Although tetronal and trional are, for all practical purposes, interchangeable, each has slight advantages and disadvantages. Tetronal may be given as a *sedative hypnotic* in cases of *insomnia due to nervousness* or *restlessness* dependent upon organic nervous disease or functional disturbances. It has no great value as a hypnotic when sleeplessness is due to pain, and it is not to be recommended in the higher degrees of psychic disturbance or when delirium is present. It does not seem to be injurious when administered for the *sleeplessness of the acute infectious diseases*.

Administered in doses of from 5 to 30 grains from a half to a quarter of an hour before bedtime, it produces a quiet, dreamless sleep of a puration varying with the dose. Its effects seem to depend upon the age, sex, constitution, and disease of the patient, and the dose must be regulated according to these conditions. It requires from fifteen minutes to half an hour for tetronal to produce its effect, which is usually more sedative than that of trional and equally hypnotic. Renewed too frequently, its hypnotic influence may become blunted, and in these instances trional will usually exert the desired effect.

After the ingestion of tetronal, or on the day following its administration, there may be a complaint of lassitude and drowsiness, and, according to some observers, there is no other ill effect from its use. Other writers have reported pain in the head, anorexia, nausea and vomiting, vertigo and inco-ordination, and disturbances on the part of the kidneys. When these symptoms arise, the drug must be at once withdrawn and emeto-catharsis and diuresis must be evoked.

Tetronal may be found in the urine as such, not being decomposed in the body, as might be expected from its composition. If not excreted at once, it may subsequently have a delayed or postponed action, like sulphonal. It is a usual practice, therefore, to discontinue its administration after it has been given for three or four nights. It is said that no tetronal habit is formed.

Tetronal is most advantageously given in hot milk. The average dose is 15 grains, which may be repeated, if necessary, in an hour. (See TRIONAL.)—SAMUEL M. BRICKNER.

TEUCRIN.—This is a dark-brown liquid, an aqueous extract of *Teucrium scordium*. It is furnished in the form of hermetically sealed glass tubes, each containing about 45 grains of the liquid. Professor von Mosetig-Moorhof has used teucrin extensively in the treatment of *cold abscesses*, *tuberculous adenitis*, *lupus vulgaris*, and *actinomycosis*. The contents of a tube are injected subcutaneously. The action of the remedy is to set up an inflammatory action around the tuberculous or other deposit, after the manner of tuberculin, and so bring about its expulsion. Some observers report that it causes a rise of the temperature, but others have not noticed any such effect. According to Dr. Cerna, 10 grains of teucrin, made into an ointment with lanolin and olive oil and applied to *hæmorrhoids* once a day, are said to give great relief.

TEUCRIUM. — *Teucrium scordium*, the garlic-germander, or water-germander, of Europe, an ajugeous herb, was formerly used as an *anthelminthic*, *diaphoretic*, and *tonic*. It has lately come into notice again as the source of *teucrin* (*q. v.*).

THALLASOTHERAPY may be held to include sea bathing, residence upon the seashore, with such occupations as fishing, boating, etc., and sea voyages. There are few conditions in which any of these would be contra-indicated, and they are those in which moist air has an injurious effect upon the mucous membranes of the air-passages, as in tuberculosis, and catarrhal states in which there is a tendency to relaxation and flabbiness of the mucous surfaces and when the diminution of the amount of moisture exhaled by the skin

and through the lungs would be injurious, as in Bright's disease. Also acute affections of the eyes in which a strong light is irritating would be a contra-indication. Moreover, some persons with a rheumatic tendency are apt to suffer more from rheumatism at the seaside than in the interior. Those who receive the greatest benefit are *convalescents from acute disease* and those run down by *overwork*, *mental anxiety*, or *excesses* of any kind. The relief sometimes gained by the victims of *hay fever* by residence upon an arid shore is hardly to be attributed to any specific element in the air, but rather to the absence of the exciting cause, pollen.

It is usual for removal to the seashore, even by those in robust health, to be followed by increased appetite and great capacity for sleep, which is usually profound and refreshing, although some, especially children, are made sleepless for a while by the noise of the waves on the shore. This, however, usually wears off in a day or two and is only one of the minor disadvantages to be considered. Constipation or diarrhœa sometimes occurs at first, but either yields to the simplest treatment. When the question of bathing is of little importance, the most desirable points are upon the coast of Maine and the British provinces, as hot days are the exception and cool nights the rule. Many other points upon the Atlantic Ocean can be found, such as along the Rhode Island, New Jersey, and Long Island shores, where the conditions are nearly as favourable and are as a rule fairly satisfactory. It is desirable that some locality not in the vicinity of wooded or marshy spots should be selected, as when they exist mosquitoes are almost sure to be found, and, while they may not be very annoying to persons in good health, they are a serious complication for those out of health. In marshy places they may be kept down to a considerable extent by pouring small amounts of crude petroleum upon the surface of the water. This either destroys the larvæ or prevents their escape, and the procedure, if carried out with regularity, will undoubtedly diminish the number in a very marked manner.

The coasts of tropical and semitropical localities are freely visited during the winter months, but caution in selecting appropriate cases must be exhibited, as the humidity is generally greater than at the Northern resorts, and there is more temptation to exposure. For persons in good health there are no particular objections to be urged against them.

It is safe to assume that malaria is absent from the large majority of seaside resorts in the northern portion of the United States, but in the warmer portions it may be found where the soil consists largely of decomposed vegetable matter, or where extensive marshes which are only semi-occasionally covered by water are found. Many such localities exist along the shores of the Gulf of Mexico, and they should be avoided during the warmer months. In many of the small settlements made up of cheaply constructed houses crowded closely together the sanitary arrangements are very bad and the water supply is apt to be contaminated from the privy vaults. As a result, numerous cases of typhoid fever have been directly traced to them. This point should therefore be carefully looked into in selecting a locality. It is also unfortunate that in too many instances the food, etc., are poor, and whatever benefit might be derived from the sea air is overbalanced by the lack of reasonable comforts.

The belief that exposure to the night air of the seashore or fogs and being wet by salt water are less apt to be followed by "catching cold" than like occurrences inland is widespread and is certainly true in a measure. The fact is probably due to the better general condition of the person and to the moderate stimulation of the cutaneous circulation.

The effect of the sun is an element not to be lost sight of in residence upon the seacoast, and the practice of spending hours upon the sand in the scantiest possible bathing suits is to be encouraged, especially among children, but unless they are very strong they should not be allowed to dash in and out of the water, although in those with a sluggish circulation the evaporating of the salt water upon the surface of the body and the stimulant effects of the salts left may be beneficial. When considerable time is spent upon the sand it is wise to protect the head from the direct rays of the sun by an umbrella or something of the sort, and persons with skins particularly susceptible to the action of the sun should begin cautiously, so as to avoid blistering.

When bathing is the principal attraction to the shore, the question as to whether still water or an ocean beach should be selected is one which will depend upon the physical strength of the persons concerned. Surf bathing, even under the best possible conditions, is dangerous and, except to the very strong, exhausting, and it is safe to assume that its advantages rarely counterbalance its disadvantages. Still-water bathing, such as is found in bays and large arms of the sea, is much to be preferred; yet shallow coves, etc., where the water becomes very warm, are not to be selected, as the effect of such water is enervating rather than stimulating, and, moreover, it is apt to be dirty and the bottom muddy. Children, however, do not appear to suffer from paddling around in such places. It is rather curious that *corns* are often cured by wading in the soft warm mud exposed at low tide in such localities. Young children in many instances have an unreasoning fear of the water and should not be forced to enter it. If they are allowed to "paddle" and wade around the margin they will soon lose their fear and go in freely.

The popular belief is that before breakfast is the proper hour for bathing, but it is rare that persons are found who are benefited by taking baths at that hour. The most fitting time is midway between two meals, when the system is well provided with food and the processes of digestion are completed. Bathing with the stomach full of food is apt to check digestion, and there is little doubt that many cases of the so-called "cramp" are due to the sudden shock

and resultant circulatory changes. On the other hand, it is by no means a bad plan to eat a small amount of light food soon after leaving the water. The length of time which can be spent in the water without disadvantage will vary greatly in accordance with the general health and strength of the person, and can be ascertained only by trial. It should not, however, reach the moment when the exhilarating and stimulating effects cease, as when this occurs a feeling of depression follows which may continue for hours, and the effect of the bath be bad rather than good.

For persons unaccustomed to sea bathing, convalescents, or the delicate, it is wiser to begin with a single dip and to lengthen the time progressively. As a rule, it is rare that the duration of a bath should be prolonged beyond fifteen minutes, and under all circumstances chilliness, blueness of the lips, or a fatigued feeling indicates that the limit of benefit has been exceeded. Long swims, diving, or struggling against a heavy surf should still further cut down the time, as exercise renders the system less resistant to the depressing effect of a bath. When diving, it is best to place small pieces of *absorbent cotton* in the ears to reduce the danger of rupture of the tympanic membrane. Severe exercise immediately after bathing is not to be recommended. The person should be dried as quickly as possible with rough towels, so as to cause a healthful glow upon the surface. It is common to shower with fresh water after a sea bath, but, although it is rather more agreeable to do so, it is wiser to omit this when the cutaneous circulation is sluggish, as the small amount of the salts left upon the skin acts as a stimulant to it.

Often large numbers of medusæ, popularly known as "jelly fish," are found in the water, and they are very apt to give rise to considerable irritation of the skin if they come in contact with it. Usually the pain and redness subside quickly, and some relief may be gained by sponging the surface with a weak solution of carbonate or bicarbonate of sodium. Persons with delicate skins will do well to keep out of the water when the medusæ are numerous, as sometimes a condition approaching dermatitis is set up by them.

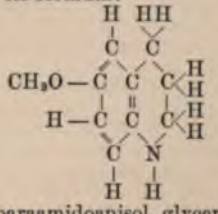
It is safe to assume that few morbid states contra-indicate sea bathing for those accustomed to it, provided the person does not become fatigued or chilled. As a rule, it would be hardly advisable to allow pregnant women to bathe indiscriminately, but if it has been customary, there would be little objection to it up to the eighth month, provided the water was calm. During menstruation it is not often proper, except when the process lasts but a few days and the condition of the pelvic organs is normal. In cases of chronic diseases the condition of the individual must be taken into account.

Bathing and prolonged residence upon the seashore are held in high esteem, especially by the French, in the treatment of the conditions grouped under the name of *scrofula*, and there is little doubt that they are of great value, but the appropriate dietetic and medicinal treatment should not be neglected. In this condition it is probable that the improved appetite and nutrition are rather more active factors than the iodine assumed to exist in sea air. During the *first dentition*, when *diarrhœa* exists, it is rare that sea air does not produce a rapid change for the better, even if its influence is exerted for a few hours only.

Sea voyages are usually of great benefit to *convalescents* or the broken down, as, when they are taken under proper conditions, there is absolute freedom from worry and the appetite is better and the sleep sounder and more refreshing. Of course there are some unfortunate individuals who suffer for many days with seasickness, and often to such an extent as to threaten life, and for them a voyage would be entirely inadmissible. For those who are not so unpleasantly affected, a day or two of seasickness is by no means a disadvantage, as enforced abstinence from food is usually followed by an improved condition of the digestive apparatus.

It is usual for constipation to exist during the first few days of a voyage, but it may be overcome by mild laxatives or the eating of fruit before breakfast. When the condition of the person approaches *neurasthenia* it is much wiser to select a trip longer than the ordinary transatlantic voyages, and, provided a comfortable sailing vessel can be found, it is much better than a steamer. At almost any time vessels can be found about to make voyages of from thirty to ninety days, and usually the officers enjoy the presence of passengers and endeavour to make them comfortable. The greatest objection to sailing vessels is that, although the accommodations are usually better than on steamers, the food is apt to be less tempting; but this is generally no great drawback, for after a few days food which on shore would be rejected is eaten with relish. On a long voyage of this kind an abundance of underclothing must be taken, as there is little opportunity for its being satisfactorily washed and ironed.—Russell H. Nevins.

THALLINE, or tetrahydroparamethyloxyquinoline, is a synthetical product first prepared by Skraup in 1885. Thoms gives the following as its formula:



By heating paraamidoanisol, glycerin, and sulphuric acid in the presence of an oxidizing agent, paranitroanisol, a substance is obtained which is called paraquinanisol. When this substance is treated with reducing agents, such as tin and hydrochloric acid, it is caused to take up four atoms of hydrogen, which changes it to thalline, so called because oxidizing agents produce with it a deep emerald-green colour. It occurs in colourless or yellowish

rhombic crystals which melt at 104° F. and recrystallize on cooling. It is soluble in water, in alcohol, and in ether, is neutral in reaction, has a characteristic aromatic odour which resembles that of the tonka bean, and enters into combination with acids to form salts, of which the sulphate, *thallinum sulfuricum* (Ger. Ph.), and the tartrate are the most important. Thalline itself is not used in medicine, but is represented by these combinations.

The sulphate is a whitish or yellowish crystalline powder, with the characteristic odour of thalline and a taste described as acid, saline, bitter, and spicy. It is soluble in from five to seven parts of cold water, freely soluble in boiling water, and sparingly soluble in alcohol. All these solutions gradually assume a brownish hue on exposure to light and air. This is the more frequently employed of these two salts, and is therefore the more important.

The tartrate also occurs in a crystalline powder which closely resembles the sulphate in appearance, odour, and action. It is soluble in ten parts of water, in which it makes an acid solution. It is very sparingly soluble in alcohol.

The thalline salts are *antiseptic* and *antipyretic*. A solution of from 4 to 5 per cent. is destructive to micro-organisms, while the internal administration of from 5 to 15 grains will cause a fall of the temperature in a case of *hyperpyrexia* of four or five degrees in two hours, but this drug is not a favourite remedy. The results of physiological experiments indicate that these salts are poisonous to the red blood-cells and to the nervous system, while clinical experience has demonstrated that they tend to lessen the cardiac energy, reduce the blood-pressure, occasion profuse perspiration, and cause extreme prostration. The administration of this drug has been followed also by chills, cutaneous eruptions, cyanosis, vomiting, diarrhœa, and albuminuria. The duration of its antipyretic action has been stated as three hours; it may be longer, but it is usually brief. It has been recommended particularly in *typhoid fever*, but it may be objected to its use that it does not exercise any influence over the disease itself, that its antipyretic action is more transient, less effective, and less safe than that of some other remedies which belong to the same class as thalline, and finally that fatal results have occurred from its use in this disease.

In *tuberculosis* thalline causes a rapid reduction of the temperature, but it has been found that this result is apt to be accompanied by alarming prostration, even when the drug has been given in small doses.

It should be mentioned that Demme, Griffiths, and others have expressed very favourable opinions of the action of thalline in reducing the temperature in high fevers in children.

As an *antiseptic*, the use of thalline has been principally confined to its employment as an injection in *gonorrhœa* and *gleet*. In gonorrhœa the use of a solution of from 2 to 4 per cent. in strength has been recommended, and some of its advocates advise that at the same time the drug shall be given internally, about 3 grains four times a day. For gleet a weaker solution is considered sufficiently powerful.

When given internally, thalline is eliminated mainly by the kidneys and gives the urine a dark, brownish colour.

The dose of the thalline salts may be said to vary from 1 to 15 grains. When thalline is used as an antipyretic, probably the best results will be obtained by giving from ½ to 1 grain every hour or two, and carefully watching the effect.—Matthias Lanckton Foster.

THAPSIA.—*Thapsia garganica*, an umbelliferous plant of Algeria and southern Europe, furnishes a very irritating resin, which is the essential ingredient of the *sparadrap de thapsia* of the French, a plaster that is used as a *rubefacient* and *vesicant*. Great care is required in its employment, for its prolonged retention in place is apt to cause ulceration.

THEA.—See Tea.

THEINE, or *trimethylxanthine*, is an alkaloid found in the leaves of *Thea chinensis*, or *Camellia Thea*, isomeric with caffeine and guaranine, and is the chief active principle in the beverage ordinarily known as tea. Its chemical formula is $C_8H_{10}N_4O_2+H_2O$. It occurs in snow-white needlelike crystals, soluble in fifty parts of cold and about two parts of boiling water, odourless and of a feebly bitter taste. Applied to the tongue, it causes a slight tingling followed by a temporary local anæsthesia.

Theine was discovered by Oudry in 1827 and pronounced identical with caffeine and guaranine by Mülder and Jobst in 1838. From that time until very recently the identity of these alkaloids was considered so certain that for commercial purposes they were extracted indiscriminately from coffee, tea, kola, maté, or Paraguay tea, and guarana, and labelled to suit the demands of trade. Most of them were extracted from tea, for economical reasons, whence it happens that many of the investigations made with regard to caffeine were unintentionally made with theine. In 1868 Leven declared that these two alkaloids were not identical, because he found that theine would cause convulsions in frogs, while caffeine would not, and that the lethal dose of theine was the larger. His observations were not confirmed by other investigators and were forgotten until, in 1885, Dr. Mays obtained some genuine theine and caffeine with which he instituted a series of experiments. These demonstrated certain important differences between the physiological action of the one and that of the other, which may thus be briefly stated: Theine affects the sensory, caffeine the motor system. Theine causes spasms, convulsions, and an impairment of the nasal reflex early in the course of poisoning, while caffeine does so at a late stage or not at all. Theine induces a fall, caffeine a rise in the bodily temperature. Theine is also a powerful *local anæsthetic* and *analgetic*.

In other respects there seems to be a general agreement between the physiological actions of theine and caffeine. Both diminish waste

of tissue, increase the rapidity of the pulse and the strength of the cardiac action, and are antidotal to narcotic poisons. Dr. Castle gives an excellent description of the cerebral intoxication produced by the injection of half a grain of theine into his own general circulation. "I was excited and talkative, and so rapidly did I talk that I would soon exhaust a subject broached by others and endeavour to introduce some natural descendant of the idea as a topic of conversation, apparently so far ahead of its proper sequence in a well-ordered train of thought as to appear like an interruption with an irrelevant subject. Alternating with states of great bodily activity were spells of almost a fainting character. These were seven or eight in number, and, beginning soon after the injection, gradually ceased after the lapse of six or seven hours."

A subcutaneous injection of theine causes a profound local anæsthesia at and below the point of injection, which extends outward along the nerve-trunk toward the periphery, not toward the centre. According to Mays, this anæsthesia appears in a few minutes after the injection of from one fifth to one half a grain, and is much more marked in some individuals than in others. It is associated with a feeling of coldness, and occasionally with reduction of temperature of the anæsthetized part, a slight reduction in the pulse-rate, but no impairment of motion or symptoms of cerebral intoxication.

The therapeutic uses of theine are largely the same as those of caffeine, but for one purpose it is peculiarly valuable, that of relieving *neuralgic pain*. But its function is only to relieve the pain, and its use should be accompanied by that of other remedies to cure the condition upon which the neuralgia depends. It has thus been used with good effect in *sciatica*, *intercostal*, *cervico-brachial*, and other forms of *neuralgia*, *myalgia*, and *lumbago*, injected in doses of ½ of a grain or more over the course of the affected nerve. Used in the same way, it has proved serviceable in relieving the *pains of locomotor ataxia*, but the dose has to be large, even as much as 3 grains having been given. (Cf. CAFFEINE.)

MATTHIAS LANCKTON FOSTER.

THEOBROMA.—See CACAO BUTTER.

THEOBROMINE.—This alkaloid, known also as *dimethylxanthine*, $C_7H_8N_4O_2$, is obtained from the fruit of *Theobroma Cacao*. The pure alkaloid is a white powder consisting of microscopic rhombic needles. It is odourless and has at first very little taste, but a bitter after-taste. It dissolves in about 1,600 parts of cold water, in about 150 parts of hot water, in about 4,300 parts of cold alcohol, in about 430 parts of hot alcohol, and in about 105 parts of hot chloroform. It dissolves readily in watery solutions of the fixed alkalies. On account of the difficulty of dissolving it in ordinary menstrua, the alkaloid itself is little used in medicine, but several of its salts are employed.

Dr. Henri Huchard (*Journal des praticiens*, July 6, 1895; *American Journal of the Medical Sciences*, October, 1895) classes theobromine among the "functional epithelial" *diuretics*, or those which act upon the renal epithelium without altering it, comprising milk, lactose, glucose, theobromine, potassium and sodium nitrates, asparagus, couch-grass, corn-silk, and elder bark. The "irritant epithelial" diuretics, such as cantharides and juniper berries, provoke diuresis by causing congestion of the kidney. Experiments with theobromine, he says, have shown that it does not possess any action upon the nervous system, thus differing from caffeine, which is a cerebral excitant. It is very slightly poisonous, even in large doses. It has a diuretic action less prolonged than that of digitalis, but more so than that of caffeine. This diuresis follows very rapidly as a urinary downpour; the amount of urine frequently becomes 3 or 4 pints. Very rarely it produces digestive disturbances, such as nausea and vomiting, which may be avoided by prescribing the drug in capsules of 7 grains each. It has no action upon the heart, arteries, or blood-pressure, and is harmless to the kidneys. It does not offer any danger of habituation or of accumulation, and it is eliminated unchanged in the urine. Finally, it is indicated in *dropsies of cardiac origin* and in the *anasarca of Bright's disease*. If it is prescribed in the dose mentioned, eight capsules should be taken on the first, six on the second and third, and four on the fourth day. Dr. Huchard regards theobromine as more trustworthy than diuretin. To obtain the *tonic* effects of this drug it is employed in smaller doses, associated with equal parts of neutral sodium phosphate, for several weeks.

A combination of equal molecules of the sodium compound of theobromine and sodium salicylate is a German proprietary preparation called *diuretin* (see SODIO-THEOBROMINE SALICYLATE). Other preparations that have been used therapeutically are the hydrochloride, the nitrate, the salicylate, the tannate, and the following-named double salts: Theobromine and lithium benzoate (Merck's "uropherine 'B'"), theobromine and lithium salicylate (Merck's "uropherine 'S'"), theobromine and sodium benzoate, and theobromine and sodium iodosalicylate.

THERAPOL.—This is an American proprietary preparation said to consist of a bland vegetable oil containing about eight per cent. of ozone by volume. (See OZONE.)

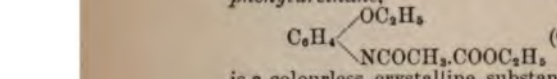
THERIACA.—See TREACLE.

THERMIFUGIN.—This is the trade name of methyltrihydroxyquinoline carbonate of sodium, $C_9H_8(CH_3).NCOONa$, a yellowish-white crystalline powder soluble in water. It has been employed to some extent as an *antipyretic*, in doses of from 1½ to 4 grains. Experience in its clinical employment has not yet been sufficient to warrant more definite statements concerning it.

THERMINE, or *tetrahydrobetanaphthylamine*, $C_{10}H_{11}NH_2$, is a colourless liquid obtained by the action of metallic sodium on a solution of beta-naphthylamine in amyl alcohol (Coblentz). Dissolved in water in the proportion

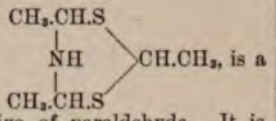
of from 1 to 5 per cent., it has been recommended as a *mydriatic*. It is said that the hydrochloride has the property of increasing the heat of the body.

THERMODINE, or *acetylparaethoxyphenylurethane*,



is a colourless crystalline substance sparingly soluble in water. It is a proprietary preparation introduced as an *antipyretic* and *analgetic* devoid of unfavourable effects, but the accounts are conflicting as to its innocence. The dose is from 5 to 10 grains.

THIALDIN,



is a crystalline derivative of paraldehyde. It is soluble with difficulty in water, but dissolves readily in alcohol and in ether. It is said to act as a *stimulant to the heart*, but enough is not known of it to warrant its use in practice at present.

THILANIN.—This is a compound of 3 parts of sulphur and 97 parts of lanolin. It has been employed topically to some extent in cases of *eczema* and other skin diseases in which sulphur may be beneficial.

THIOCAMPHOR.—This name has been given to a liquid formed by the action of sulphurous-acid gas on camphor. More or less diluted with water, it is used as a *disinfectant*.

THIOFORM, or *basic bismuth dithiosalicylate*, has been proposed as a substitute for iodoform. It is an insoluble, odourless yellow powder. According to De Buck (cited in the *British Medical Journal*, February 22, 1896, *Epitome*), it has an *antiseptic* and *desiccative* action, and forms a *protective* insulating layer for the parts to which it is applied. All raw, weeping, or *ulcerated surfaces* heal rapidly under it, he says, whether in the form of the pure powder or mixed with equal parts of levigated boric acid. It is indicated in all *ulcerative skin affections*, and where *epidermic softening* exists. Internally, he has found its constipating and disinfectant qualities manifest in three cases of *acute enteritis;* in a fourth chronic case it caused gastric irritation and did not influence the muco-sanguinolent stools. Daily amounts of 30 grains for an adult, or from 7 to 15 grains for a child, in powder or mucilage, were perfectly well borne by the stomach. He considers the drug suited for internal use, since the dithiosalicylates are less toxic than the corresponding salicylic salts.

Thioform has been used with success in *purulent otitis media*, in *conjunctivitis*, in *ulcer of the cornea*, in *ulcers of the leg*, and in *burns*.

THIOL is a German patented sulphur derivative of various mineral oils. It occurs as a liquid or solid, according to the manner of its preparation. Its freedom from unpleasant odour suggested its employment instead of ichthyol, with which its effects are identical, and it is used for the same purposes and under the same conditions. Internally, it has been given in the treatment of *rheumatism*, but with no brilliant results. The dose of the fluid variety is from 5 to 10 drops, and that of the dry thiol from 1 to 2 grains.

[Solid thiol, prepared by evaporating the liquid form, is furnished in the form of powder and in that of scales. Both solid and liquid thiol have been found very useful in the treatment of *burns*. Bidder (*Archiv für klinische Chirurgie*, xliii, 1892; *University Medical Magazine*, September, 1892) says of it that, when applied to a burned surface, it acts as a *desiccant*, relieves the pain, hardens the skin, and hinders the growth of micro-organisms if any are present.

In burns of the first or second degree, where the blebs are still intact, it is only necessary to brush the burned area with equal parts of liquid thiol and water, and cover it with wool. By this method of treatment the pain almost immediately disappears. At the end of eight days the dressing should be changed, and reapplied if the blebs have not healed. If the blebs have been ruptured and the corium is exposed, all loose skin should be cut away and the burned area carefully cleansed; it should then be brushed with liquid thiol, powdered with salicylic or boric acid and then with powdered thiol, and the whole covered with vaseline and cotton wool, and bandaged. As a rule, one or two dressings only are necessary before the burn heals. The drug is of special value in relieving the pain of large granulating surfaces in burns of the third or fourth degree.

It is chiefly in dermatological practice that thiol has been used, in the treatment of *eczema*, *erythema*, *erysipelas*, *ulcers*, and *lupus;* it is said, however, to be equal to ichthyol in *sorbefacient* virtues, and consequently to be of great efficiency in the treatment of *inflammatory pelvic exudates* and other *inflammatory deposits*. For use in these cases a 10-per-cent. ointment may be made according to the following formula:

℞ Liquid thiol..... 1 part;
Vaseline..... 2 parts;
Lanolin..... 7 "
M.

Dry thiol dissolves readily in collodion.]

RUSSELL H. NEVINS.

THIOLIN, THIOLINIC ACID, according to Professor Coblentz, is a dark-green mass of the consistence of an extract, having a peculiar mustardlike odour, insoluble in water, but soluble in alcohol. It is formed by the action of warm sulphuric acid on sulphurated linseed oil. Its medicinal properties are similar to those of ichthyol and thiol. Sodium thiolinate is thought to be preferable to thiolin for medicinal use.

THIOOXYDIPHENYLAMINE. — See SULPHAMINOL.

THIOPHENE.—This is an organic compound, $\begin{matrix} HC-CH \\ | \quad | \\ HC \quad CH \\ \backslash S / \end{matrix}$, found by von Meyer in benzene and also made synthetically from coal tar. It is a colourless, volatile oil. The *diiodide*, in the form of powder, has been used as an *antiseptic*, especially as a substitute for iodoform. The *tetrabromide*, a substitution compound, is a still more energetic antiseptic. Thiophene and its compounds are quite expensive.

THIORESORCIN, $C_6H_4(OS)_2$, is a yellowish-gray powder, a German patented preparation, made by heating resorcin with sulphur. It is insoluble in water. It has been recommended as an *antiseptic*, especially as a substitute for iodoform, but, according to Professor Coblentz, its use is followed by unpleasant symptoms.

THIOSALICYLIC ACID.—See SULPHOSALICYLIC ACID.

THIOSAPOL.—This is a soda soap containing 10 per cent. of sulphur, used topically in *skin diseases* where sulphur is indicated.

THIOSINAMINE, or *allylthiourea*, or *allylsulphocarbamide*, $NH(C_3H_5).CS.NH_2$, is a substance deposited in the form of colourless crystals of a faint alliaceous odour and a bitter taste when a mixture of 1 part each of mustard oil and alcohol and 2 parts of ammonia water, having been heated to 122° F., is allowed to cool. It is soluble in water, in alcohol, and in ether. The aqueous solution is said to be prone to decomposition.

Thiosinamine is a *diuretic*. In addition, it seems to have a peculiar reducing effect on *cicatricial tissue* and on *neoplasms*. It was first used in medicine by Dr. Hans Hebra, of Vienna, in the treatment of *lupus*. Dr. Sinclair Tousey, of New York, who has made a careful study of the use of thiosinamine by others and employed it extensively himself (*New York Medical Journal*, May 2, 1896), says that the method in which it was used by Hebra was by the hypodermic injection of a 15-per-cent. alcoholic solution deep into the muscular tissue between the shoulder blades. A fine needle was used, and the injection was made slowly. The beginning dose was from ¼ to ½ of a grain, and this was injected twice a week. In lupus cases the dose was increased in the third or fourth week to half or the whole of a hypodermic syringeful of a 15-per-cent. solution, equivalent to from 1½ to 3 grains of thiosinamine, twice a week. These doses were as well borne as so much distilled water, but Hebra says they always produced a visible curative effect. In a few cases he went as high as one and a half or two syringefuls with no bad effect. Keitel and Richter also used a 15-per-cent. alcoholic solution. Dr. Tousey used a 10-per-cent. alcoholic solution, and Van Hoorn, on the recommendation of Professor Duclaux, of Paris, used a 10-per-cent. solution in equal parts of water and glycerin. This he found just as active and not nearly so painful as the alcoholic solution. This solution, says Dr. Tousey, has the further advantage of being available for use in agar-agar cultures and the like, where the presence of alcohol would interfere.

Hebra rarely used as much as 3 grains, and Dr. Tousey never exceeded 1½ grain, but the other observers cited by him used 4½ grains as a regular full dose, beginning, of course, with smaller ones. Dr. Tousey finds that if an alcoholic solution is used there is sharp pain lasting for less than a minute. This may be somewhat diminished by pressure to diffuse the solution through the tissues. The syringe has to be washed out with water after the use of an alcoholic solution, otherwise the leather washers on the piston become dried and loose.

Like Hebra, Dr. Tousey has found it desirable to suspend the use of thiosinamine for ten days every six weeks or two months.

Bacteriological studies of thiosinamine, says Dr. Tousey, have been reported by Hebra and Van Hoorn. Hebra at first found that rabbits were apparently made proof against anthrax, but in a second series of experiments all the rabbits died. Van Hoorn found that the presence of a small percentage of thiosinamine in a culture medium rendered ineffectual an inoculation with certain bacteria. The addition of a few drops of a 10-per-cent. solution retarded or rendered the further growth of a culture impossible; but even flooding it with thiosinamine for twenty-four hours did not kill any bacteria.

The physiological effects upon animals have been studied by Hebra, says Dr. Tousey. He injected 3 grains daily for a month into a dog weighing twenty-two pounds. The dog remained perfectly normal, but became ravenous, and gained nine pounds in weight. He further injected into curarized animals doses ten or twenty times as great in proportion to their weight than in those used on man. The only effect was a slight lowering of the pulse curve, and this was evidently due to the alcohol in which the drug was dissolved.

Its physiological effect in man, says Dr. Tousey, is in a general way that of a very mild *tonic*. If the subject is perfectly sound, there are no symptoms at all produced by the injections, and if there is a lesion present the reaction which may occur is local, and is not accompanied by any general symptoms. Especially, there is never any febrile movement. There is in all cases a tonic effect with an increase in weight. Hebra states that absorption of the drug is very rapid, since his patients noticed a garlicky taste in the mouth within a few minutes. The same author has noted an extraordinary diuresis, the increase in the daily amount of urine being two hundred or five hundred cubic centimetres. In no case were there renal symptoms, or was there albumin or any other pathological product in the urine. This diuresis ceases after a number of injections. Hebra thinks it is a therapeutic action and ceases after the abnormal fluids have been eliminated. Van Hoorn and Keitel, who both used large doses, noted after several weeks' treatment the onset of nausea, headache, and lassitude. Hebra used smaller doses

and Dr. Tousey still smaller ones, and they have not had such an experience.

Dr. Tousey cites Richter as having studied the effect of thiosinamine on the blood in a number of cases of *lupus vulgaris*, *lupus erythematosus*, *ulcer of the leg*, and *cicatricial stricture of the urethra*. He noted the number of white and red blood-cells, the amount of hæmoglobin, and the changes in the morphology of the histological elements of the blood. Blood examinations were made just before the injection, four hours later, and again twenty-four hours afterward. In some cases examinations were made half an hour afterward, and in eight of these cases a change in the number of leucocytes had already taken place. The blood was always obtained by pricking the finger tip and without pressure, and always at the same hour of the day. There was uniformly an immediate decrease in the number of leucocytes to one third of the normal number—viz., from about fourteen thousand down to four thousand to the cubic millimetre. But at the end of four hours the number of leucocytes had increased to normal or beyond, and in some cases there was well-marked leucocytosis which persisted for forty-eight hours. There were no uniform changes in the number of red cells. The amount of hæmoglobin was regularly increased. There was no special effect upon the number of eosinophile cells, but there was a uniform increase in the number of multinuclear leucocytes or leucocytes with polymorphous nuclei.

Richter states that in its action on the blood thiosinamine belongs to the same class of substances as hemialbumose, peptone, pepsin, nuclein, pyocyanin, tuberculin, curare, urea, uric acid, and sodium urate, the intravenous injection of any of which substances causes an immediate leucocytolysis followed by leucocytosis.

According to Dr. Tousey, there has been only one accident reported from the subcutaneous use of thiosinamine. It consisted in the production of temporary cutaneous anæsthesia, and was observed by Keitel. The patient was a robust youth with recurrent psoriasis of a papular type, and thiosinamine was used with a view to causing absorption. The injections were made at various points, and the last one into the muscles of the extensor aspect of the forearm. This was followed very shortly by complete anæsthesia of the skin supplied by the cutaneous branch of the musculo-spiral nerve. It could not be stated positively that the nerve had been wounded by the needle, which Dr. Tousey thinks probable, and Keitel thought the effect was due to the action of the drug itself upon the nerve. In one of Dr. Tousey's cases twenty-seven hypodermics of thiosinamine were administered in the left biceps at approximately the same spot without any unfavourable effect.

The effect of thiosinamine upon pathological conditions, says Dr. Tousey, is that of a powerful *absorptive*, acting probably by increasing the activity of the lymphatic system. This effect is seen in the absorption of *serous exudations*, which is accompanied by marked diuresis. It is also visible in its effect upon *lupus*, *corneal opacities*, *cicatrices*, *glandular swellings*, and *neoplasms*. Hebra used it in a number of tuberculous patients who had had no recent pulmonary symptoms, and observed a return of fever after the injections. In such cases the fever is perhaps due, Dr. Tousey suggests, to the absorption of encapsulated pus. In one case with very severe night sweats there was repeatedly a marked amelioration following the injections. This was verified by control experiments. This same absorptive effect is so active locally that in some classes of cases a latent process may be fanned into an active one. This is especially the case in its use for clearing up opacities of the cornea; if there is the slightest inflammatory condition present it will be very much aggravated, and treatment will have to be suspended. In some cases, says Dr. Tousey, this local inflammatory reaction is of benefit. Cases have been reported in which an apparently cured osteomyelitis has started up again after the injections—a new abscess has formed, a sinus has opened, and an *old* sequestrum has been extruded. This has been followed by definitive healing, and the entire process could only be regarded as having been a beneficent one.

The results obtained by Hebra, Richter, Van Hoorn, and Tousey are somewhat at variance. Hebra and Van Hoorn observed in practically every case a local reaction which they describe as beginning in two or three hours after the injection. The diseased part became red and swollen, sometimes so much so as to cause fissures in the surface. There was no vesication and there was little if any serous exudation. This reaction remained undiminished for five or six hours, but at the end of twenty-four hours had entirely disappeared. Marked desquamation sometimes follows. There was never a general reaction, and especially there was no fever. There was a sensation of heat and tension in the affected part. These two authors, says Dr. Tousey, report this reaction to have occurred in practically every lupus case, and to have been repeated without material increase of the dose after each injection. Dr. Tousey's own lupus cases have been in dispensary practice, and the patients have not been seen until forty-eight hours after the injection. So far as the patients' statement can be credited, they have not shown a local reaction. Richter had a comparatively large number of cases of lupus (eleven), and in only two was there any reaction, and then only with the first two or three injections. His cases were under constant observation, and the doses used were large.

As to the curative action upon *lupus*, says Dr. Tousey, Van Hoorn and Hebra observed a very great effect indeed wherever the superficial area of disease was great. Ulcerations healed, and the thickened and nodular edges flattened out. No case of complete cure is reported, and where the area involved was quite small—lupus of the cheek of the size of a dime—it was hardly influenced at all. Richter has seldom seen any effect at all upon lupus. In Dr. Tousey's own cases no "reaction" has been noted, but he has uniformly seen a diminished

vascularity and a softening of the edges with healing of the ulcer. He agrees with the other authors cited that local treatment is a better means of handling lupus than the use of thiosinamine.

Its therapeutic application in clearing up *corneal opacities*, he remarks, has been attended with almost perfect success in the hands of all the investigators. Hebra had a patient who, before the injections, could hardly avoid collisions with people on the street, and afterward the acuteness of vision had so increased as to enable him to tell the direction of the wind by the weather vane on a high tower. He and Richter report a number of such cases, and give the formulæ for vision before and after treatment, demonstrating a remarkable increase. This Dr. Tousey thinks is of the greatest possible importance, for we can promise almost all these patients an astonishing improvement in vision. The cases for which it is unsuitable are those in which a vestige of inflammation is still present and might be started up into fresh phlyctænulæ.

In the treatment of *cicatricial contractures*, says Dr. Tousey, thiosinamine acts by causing absorption of the fibrous tissue, whether it is situated in the skin or in deeper parts, such as tendons and ligaments; and all the authors cited report complete cures of such cases. Among these are *ectropion* following lupus of the cheek, partial *ankylosis* of the knee from lupus, and *talipes equinus* following a burn of the leg. One case of ectropion was so marked that the eye could not possibly be closed, the tarsal cartilage was so rarefied by pressure and traction as to be scarcely perceptible, and even the corner of the mouth was drawn up toward the eyelid. This patient was restored to a normal condition, and the skin of the cheek became soft and freely movable on the subjacent tissues. In another case of Hebra's there was such contracture following lupus of the palm that the finger nails grew into the flesh. Complete extension was possible after about twenty-five injections, no other treatment having been employed. Dr. Tousey says it was this wonderful absorptive power over cicatricial tissues which suggested to him its use in *keloid* and *malignant neoplasms*.

In the treatment of *simple ulcers* and of *stricture of the urethra*, Richter's six cases, with an average of eight injections, gave negative results; but Dr. Tousey would not regard this as final. In the case of *stricture of the urethra* or *rectum*, he believes the use of thiosinamine might be a very valuable adjunct to local treatment.

Dr. Tousey remarks that the action of thiosinamine upon *chronically enlarged glands* has been observed by Hebra, and it is to cause a very rapid absorption. In syphilitic cases, on the other hand, absorption was not effected; and he believes that this may in some cases be of diagnostic value. He and the other authors cited have not used it in the treatment of glandular swellings secondary to epithelioma or carcinoma. It has been used with success for *uterine myomata*. It has been used with negative results in eczema, psoriasis, and lupus erythematosus.

Dr. Tousey records a case of *keloid* in which he used thiosinamine. The patient was a man thirty-two years old. In September, 1893, his left arm was burned from shoulder to fingers. An area about four inches and a half in diameter immediately above the elbow healed by granulation, but the rest of the burn was more superficial. About four months after the accident the cicatrix began to itch and burn, and very soon a hard, prominent mass had formed in the scar. When he was admitted into St. Bartholomew's Clinic, on July 7, 1894, he presented a typical keloid, consisting of two areas, each of the size of a silver dollar and projecting three quarters of an inch above the surface. These were on the flexor aspect of the arm just above the bend of the elbow. The treatment consisted in injections of thiosinamine into the left biceps twice a week. The man had applied for treatment because of impaired motion at the elbow. The beginning dose was $\frac{3}{4}$ of a grain of thiosinamine, in 10-per-cent. solution in absolute alcohol, and the highest dose used was $1\frac{1}{2}$ grain. These injections produced no special effect except on the neoplasm. After one or two injections this became very much paler, and after twelve one portion had lost its thickening and induration. This part was then visible as apparently normal skin, but a little paler than the rest. The other area gradually changed to the appearance of normal skin. The cure was complete after twenty-seven injections had been given. Complete use of the arm was restored, and there was no thickening or adhesion of the skin, though the cicatrices were still recognisable.

Dr. Tousey concludes his valuable article as follows: "We have in thiosinamine a drug producing, when given hypodermically, no general symptoms, and even when long continued no harmful effects. It acts specifically upon certain abnormal tissues to cause their absorption or conversion into normal tissues. It is of doubtful efficacy in lupus and a variety of skin diseases. But it is of the greatest possible value in the removal of cicatricial contractures following lupus or any other cause of loss of substance. The frightful contractures from burns of the neck would yield to its action, as cases of ectropion and corneal opacity do. My own cases have shown its curative effect upon keloid, and its palliative and probably curative effect on malignant tumours."

THIOSULPHATES. — See HYPOSULPHITES.

THIURET, $C_8H_7N_3S_2$, an oxidation product of phenyldithiobiuret, is a white crystalline powder soluble in alcohol and in ether, but not readily in water. Its salts, the salicylate, the hydrobromide, the hydrochloride, etc., are more soluble in water. Thiuret and its salts are *antiseptic*, and have been recommended as substitutes for iodoform.

THORN-APPLE.—See STRAMONIUM.

THOROUGHWORT.—See EUPATORIUM.

THUJA, or *arbor vitæ*, was formerly official in the U. S. Pharmacopœia, but was dropped in the last revision on account of lack of valuable medicinal properties. The leaves and small twigs are the parts employed, and a fluid extract or saturated tincture is the preparation most commonly used. Either of these may be given in drachm doses. Thuja has been employed in *malarial fevers, rheumatism*, and a variety of diseases, but is of little or no value.—Russell H. Nevins.

THUS AMERICANUM (Br. Ph.).—See Olibanum.

THYMACETINE, a white crystalline powder, is a derivative of thymol, having the formula $C_6H_2.CH_3C_3H_7\begin{cases}OC_2H_5\\NH(C_2H_3O)\end{cases}$. It was first obtained by Hofmann, of Leipsic.

In its chemical composition it bears the same relation to thymol as phenacetine does to phenol. It probably combines the *antiseptic* properties of thymol with the general characteristics of phenacetine. Thymacetine is very slightly soluble in water.

The most exhaustive physiological study of thymacetine has been made by M. Marandol de Mentyel (*Bulletin général de thérapeutique*, vol. cxxiv), although Jolly had previously reported upon it clinically (*Centralblatt für die gesammte Therapie*, February, 1892). The latter found that in doses of from 3 to 15 grains thymacetine ameliorated *nervous headaches*, and had a general *analgetic* effect which might be compared to that of phenacetine. Occasionally the drug exhibits a *hypnotic* influence, which is not so permanent or reliable as that of other coal-tar hypnotics. As disagreeable concomitant actions, Jolly noted occasionally cerebral congestion and a tendency to drowsiness. Although his physiological experiments were limited, Jolly found that doses of 30 grains were not poisonous to dogs.

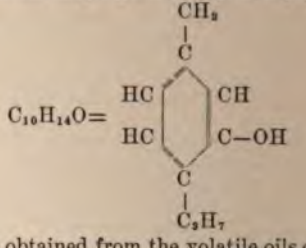
De Mentyel (*loc. cit.*) finds little or no hypnotic effect from doses of 22 grains of thymacetine. His experiments also lead him to believe that the drug is without effect upon the intellect, exciting in paralytics and demented insane persons neither exaltation nor depression. Upon the vaso-motor system, the genital tract, the secretions in general, and the gastro-intestinal canal, he found thymacetine without effect. Although the drug, as Jolly maintained, sometimes produces cerebral congestion, de Mentyel agrees with that observer that it is valuable in *headaches of nervous origin*. Whether the increase of muscular force observed after the ingestion of thymacetine is due to an increased activity of the nervous system or of the muscular fibre has not been determined; but the writer inclines to the former view, since he has frequently observed a rise of temperature of from one half to one degree lasting from one to two hours. The increased frequency of the respiratory movements—from one to six a minute—noted after the administration of thymacetine de Mentyel is also convinced should be attributed to the over-activity of the nervous system, since the emotional condition of his patients can not account for the phenomenon, for the experiments were repeated several times with a uniform result. At the same time, an acceleration of the pulse, from three to fifteen beats a minute, was noted, and a decided increase in the arterial tension was observed. This combination of phenomena would probably account for the clinical congestion of the cerebrum seen. De Mentyel noticed no diuretic effect of the drug.

That author, in his *résumé*, says that the physiological effects are independent of the size of the dose. The following phenomena were observed in connection with the experiments, which also proved to be in no wise dependent on the size of the dose given: There was sometimes a pupillary dilatation with no visual disturbance; a slight headache sometimes supervened, most frequently in the afternoon; the force of the cardiac beat was not influenced, despite the increase of arterial tension and rapidity of the pulse. Occasionally lassitude was observed without severe functional disturbance; a coated tongue, slight anorexia, and epigastric pain occasionally appeared; very rarely there were nausea and vomiting, which promptly disappeared upon the withdrawal of the drug, as did an occasional uretero-vesical spasm and dysuria. In conclusion, de Mentyel remarks that paralytics seem most susceptible to the influences of the drug.

The dose of thymacetine is from 3 to 15 grains, repeated three or four times daily. Owing to its insolubility, it is best given in capsules or wafers.—Samuel M. Brickner.

THYME, *herba thymi* (Ger. Ph.), is the leaves or flowering tops of *Thymus vulgaris*. It is fragrant and stimulating to a surface to which it is applied. The volatile oil, *oleum thymi* (U. S. Ph., Ger. Ph.), is employed as a *stimulant* and *antiseptic* application, acting by virtue of the thymol contained in it. The herb of another species, *Thymus Serpyllum, herba serpylli* (Ger. Ph.), also furnishes a volatile oil having similar properties to those of the oil derived from *Thymus vulgaris*. Oil of thyme may be used internally as a *carminative* and *stimulant*, in doses of from 1 to 3 drops on sugar.

THYMOL (U. S. Ph., Br. Ph.), *thymolum* (Ger. Ph.), is a phenolic stearoptene known in chemical language as propylmethylphenol,



It is obtained from the volatile oils of *Thymus vulgaris, Thymus Serpyllum, Monada punctata, Carum punctatum*, and some other allied plants in one of three ways—either by saponification with sodium hydrate and then treating the separated soap with hydrochloric acid,

or by fractional distillation of the oils, or by means of prolonged refrigeration under the influence of which it crystallizes. It occurs, according to the U. S. Pharmacopœia, in large crystals of the hexagonal system, nearly or quite colourless, having an aromatic, thyme-like odour, a pungent, aromatic taste, with a very slight caustic effect upon the lips, and a neutral reaction. Soluble in 1,200 parts of water and in 1 part of alcohol at 15° C. (59° F.), in 900 parts of boiling water; freely soluble in boiling alcohol, also in ether, in chloroform, in benzol, in benzin, in glacial acetic acid, and in the fixed and volatile oils. It liquefies with camphor. Its specific gravity as a solid is 1·028; after fusion it is lighter than water. It melts at about 50° C. (122° F.), remaining liquid at lower temperatures, and boils at about 230° C. (446° F.). The crystals when rubbed develop electricity and attract small pieces of paper.

In its physiological action thymol bears a resemblance to carbolic acid, and also to oil of turpentine. It is said to interfere more powerfully than carbolic acid with the development of schizomycetes, while it is at the same time much less caustic, irritating, or poisonous. When applied to the skin or mucous membranes, it causes paralysis of the end-organs of the sensory nerves and thus induces local anæsthesia, but it can not be employed for this purpose after the manner of cocaine, because when applied in a sufficiently concentrated form to produce this effect it is also a strong local irritant. Large doses cause a sensation of heat in the epigastrium, diaphoresis, tinnitus aurium, deafness, and a feeling of constriction about the forehead. Toxic doses depress the nerve-centres in the medulla oblongata and spinal cord, lessen reflex action, reduce the temperature, render the respiration slow, lower the arterial tension, produce muscular weakness, and may cause death in coma. Thymol is eliminated by the respiratory and urinary organs, which show a decided irritation during its excretion. The urine is increased in quantity and becomes of an olivé-green hue, as in carbolic-acid poisoning.

Thymol is not very frequently used in internal medication, but good results from its employment in a number of diseases have been reported. For this purpose it may be given in powder, capsules, or emulsion, which are recommended as preferable to either alcoholic, watery, or alkaline solutions. It has been used in *acute articular rheumatism*, but has not proved so effective as salicylic acid. Its use as an *antiseptic* to restrain *abnormal fermentative processes in the alimentary tract* during *acute* and *chronic intestinal disorders* in both adults and children has some warm advocates. In *typhoid fever* it has been said to reduce the temperature, to cause the stools to become less frequent and less offensive, to lessen the *tympanites*, to cause the tongue to become clean and moist, to diminish the excretion of urea, to render the cerebral symptoms less severe, and to increase the blood-pressure without injury to the heart. For all cases of intestinal derangement thymol may be given in doses of from ½ to 3 grains several times a day. The aggregate may amount to, but should not exceed, half a drachm in twenty-four hours.

Cases of *chyluria* have been reported in which the disappearance of the fatty matter and of the filariæ appears to have been greatly expedited by the ingestion of from 1 to 5 grains three times a day. Nugent recommends it to be given in combination with 15 or 20 grains of gallic acid. In *catarrh of the bladder* it is of advantage to supplement the internal administration of the drug with local treatment, washing out the organ with a solution of from 1 to 2,000 to 1 to 1,500 in strength.

Good results have been obtained from its use in *diabetes*, but it seems to produce very slight if any effect, unless the patient is confined to a purely nitrogenous diet.

Most *headaches*, with the exception of true migraine, are alleged by Jolly to be as amenable to thymol in average doses of 7½ grains as to phenacetine.

In diseases of the respiratory tract thymol has been more commonly used, principally in combination with other agents, as a cleansing, deodorizing, and stimulating local application, also as an inhalant, and less frequently as an internal remedy. It appears to exercise a good influence in some cases of *phthisis*, and is useful as a disinfectant for the sputum. Inhalation of thymol is not infrequently of service in *diseases of the upper air-passages* as well as in *bronchitis* and *whooping-cough*, and it is said to excite the flow of blood through the lungs. A good formula is the following, suggested by Dr. Clarence Rice, a teaspoonful of which may be added to boiling water and the steam inhaled:

℞ Menthol, Thymol, Carbolic acid, each..... 5 grains;
Oil of eucalyptus..... 2 fl. oz.;
Oil of *Pinus silvestris*..... 3 " "
M.

This may also be inhaled by pouring a few drops on cotton or a sponge and holding it to the nostrils.

In *atrophic rhinitis*, the *purulent rhinitis of children*, and other diseases of the nasal cavity its cleansing and deodorizing properties render it very useful and afford a certain degree of comfort to the patient and his friends, but in atrophic rhinitis at least it can not be said to influence to any great degree the course of the disease. The following is a solution proposed by Dr. Douglas for this purpose:

℞ Thymol..... 10 grains;
Eucalyptol..... 20 "
Menthol..... 30 "
Oil of cubeb..... 40 "
Oil of rose..... a sufficiency;
Benzoinol..... 4 oz.
M.

The amounts of the various ingredients may be varied as a stronger or weaker effect is desired. In the treatment of diseases of the nasal cavity, weak solutions of thymol may be used in the form of a spray, but stronger ones should be applied by means of a cotton-car-

rier. According to Seiss, the following is a preparation of minimum strength from which a therapeutic effect can be expected:

℞ Thymol..... ½ grain;
Alcohol..... ½ drachm;
Glycerin..... 1½ "
Water..... 1 oz.
M.

A stronger solution than one of 5 grains to the ounce is seldom if ever required.

In the *laryngitis* and *pharyngitis of the exanthemata*, especially when associated with putrid exhalations, the use of a watery solution from 1 to 3,000 to 1 to 1,000 in strength has been recommended as a gargle or spray. Likewise in diphtheria the use of a strong solution as a lotion or spray has been alleged to do some good. Its fragrant odour renders thymol a very pleasant constituent for a lotion of this nature or for a mouth wash for use in ulcerated or other conditions which require the use of an antiseptic, or to remove the smell of tobacco from the breath, but after a prolonged use of the drug this odour becomes disagreeable to many people.

It has been strongly recommended as a *vermifuge* for several varieties of intestinal parasites, but very large doses are necessary to render its use effectual. Some writers doubt its ability as a *tæniacide*, but the following procedure is said to be effective. During the evening previous to the administration of the drug the patient should take half an ounce of castor oil. In the morning 60 grains of thymol are to be given, divided into twelve doses at intervals of fifteen minutes, and twenty minutes after the last dose half an ounce more of castor oil is to be taken. It is acknowledged that, in spite of free stimulation during this treatment, there may be a decided fall of the respiration, pulse, and temperature. Sandwith maintains that thymol seems to have a specific action as an *anthelminthic* in *ankylostomiasis*, and gives for this purpose from 60 to 90 grains in divided doses during the day, repeats this in a week, and repeats it again if necessary. He also acknowledges that 60 grains in the course of a day may cause symptoms of collapse. While it may possibly be true, as has been alleged, that there is no danger of fatal poisoning from less than 100 grains per diem, still the appearance of such toxic symptoms as the result of the ingestion of 60 grains demonstrates that such doses are risky, although apparently necessary to secure anthelminthic action.

Gratifying results have been obtained from the use of solutions as vaginal douches in *leucorrhœa*, and to correct *offensive lochia*. It has been used dissolved in glycerin to the strength of from 1 to 3,000 to 1 to 1,000 on cotton as a tampon in the treatment of *erosions of the os uteri*.

Thymol is said to be able to arrest *dental caries*, and Hartmann has found it useful in *inflammation of the dental pulp*. He cleanses the carious cavity and inserts a bit of cotton which has been powdered with thymol. To hasten its solution and action, he advises that the mouth be washed out several times with lukewarm water.

As an antiseptic lotion a solution of from 1 to 3,000 to 1 to 1,000 has been used to some extent for wounds, burns, and ulcers, as well as for cleansing instruments during operations and for preserving sponges in an aseptic condition. For these purposes it is of about the same utility as carbolic acid, and presents fewer objectionable features, but will probably never become popular, because it furnishes a powerful attraction for flies. Painted on the skin in *pruritus*, it gives marked relief. A solution which has been recommended to be kept in stock as a basis from which to prepare any desired solution for external use is the following:

℞ Thymol..... 15 grains;
Alcohol..... 2½ drachms;
Glycerin..... 5 "
Water..... 1 pint.
M.

In a number of skin diseases, such as *ringworm of the scalp*, *acne*, *pityriasis*, *psoriasis*, and *eczema*, thymol has been successfully employed, usually in the form of ointments which vary in strength from 10 grains to the ounce upward. When an ointment of greater strength than 20 grains to the ounce is desired the thymol should first be dissolved in alcohol, a grain to a minim. Guladze reports excellent results in *favus* from the following treatment: The hair is cut short and the scalp washed daily with green soap for four or five days. Then an ointment of 1 part of thymol, 8 parts of chloroform, and 36 parts of olive oil is applied and renewed three times a day. As soon as the crusts begin to fall the hair is pulled out and the ointment applied directly to the diseased part. He says that recovery takes place in from three to four weeks, but recommends the application for a week longer of a mixture of 2 parts of iodine and 1 part of glycerin twice a day.

MATTHIAS LANCKTON FOSTER.

THYMUS EXTRACT, THYMUS FEEDING.—The thymus gland, an organ of fœtal and early infantile life, usually, as is well known, ceases to grow soon after birth and at the age of puberty begins to undergo fatty degeneration and atrophy. Sometimes a "revival" of the gland—that is, its renewed growth, with presumably a resumption of its functional activity—takes place in adult life. This occurrence has been observed almost exclusively in persons affected with *exophthalmic goître*, and it is supposed to be a provision of Nature whereby the gland, having recovered its functional power, produces an internal secretion that serves, as Mr. David Owen, of Manchester, England, says, to neutralize the toxic agents which caused the disease. At the annual meeting of the British Medical Association held in 1896 Mr. Owen read a paper entitled Thymus Feeding in Exophthalmic Goître. According to an abstract of Mr. Owen's paper published in the *Lancet* for August 22, 1896, he described three cases of this disease under his care that had been treated with thymus gland. The first had been described in the *British Medical*

Journal for February 15, 1895. Since then Mikulicz, Cunningham, Edes, Solis-Cohen, Maude, and Todd had reported on the same treatment with confirmatory results. All three of Mr. Owen's patients had been restored to health by the treatment. The dose of the raw gland was from ½ to 1 oz. three or four times a week. The relief obtained in these cases must have been more than a coincidence, he thought, as in one of his cases and in several recorded by others discontinuance of the use of the gland had been followed by relapse, but on resuming it the patients had again improved. Upon one occasion a patient of his who always had been benefited by the treatment failed to respond to the glands. This was found to be due to their having been taken from full-grown sheep. On his giving calf's thymus most urgent symptoms were at once relieved, especially *dyspnœa*, *palpitation*, and *tremors*. The heart, which had been irregular and rapid, improved greatly in a few days. Others had had quite as striking results. The probability of the theory that hypertrophy of the thymus had a curative tendency was supported by the fact that other lymphoid structures, including the spleen, were also found enlarged, and it was well known that increased lymphoid activity with consequent leucocytosis occurred in toxæmic conditions and served an antitoxic purpose. Further confirmation of this theory was derived from the fact that pregnancy often relieved Graves's disease, and this might be due to the physiological leucocytosis which existed then. It was noteworthy that this disease was almost unknown in infancy, when the thymus gland was present. The fact that the thyreoid gland was more active during infancy than later would render the infant more liable to hyperthyreoidization were there not some counteracting influence which the thymus gland possibly supplied. Mr. Owen thought there was evidence of antagonism between the thyreoid and thymus glands. Thyreoid extract increased tissue waste. On the other hand, the thymus gland was most developed during infancy and in hibernating animals at each period of hibernation, which pointed to this gland exerting an inhibitory influence over waste. This theory had been strengthened by the results of experiments and by the effects produced by disease of the thymus gland. The thyreoidal secretion, too, had a stimulating influence over the cerebral functions, and increased activity of the sexual organs was associated with enlargement of the thyreoid gland. On the contrary, during hibernation, when the thymus gland attained its greatest size, the cerebral and sexual functions were suspended and in infancy were undeveloped, but underwent rapid development at puberty, when the thymus gland finally disappeared. This apparent antagonism supplied, in Mr. Owen's opinion, a hypothetical explanation of the mode of action of thymus in the treatment of exophthalmic goître—a disease most probably due to excessive activity on the part of the thyreoid gland.

Reinbach (*Mittheilungen aus der Grenzgebieten der Medizin und Chirurgie*, i, 1896; *Gazette hebdomadaire de médecine et de chirurgie*, September 27, 1896) reports thirty cases of *goître* in which sheep's thymus was used, sometimes in its natural state and sometimes in the form of pastilles of English make. The thymus was administered in the form of hash spread on bread, in quantities of 150 grains for children and 225 grains for adults, three times a week. Larger quantities did not seem to act more energetically. The effects of the treatment were ordinarily manifested at the end of three or four weeks, and the results remained the same when the treatment was continued for a longer time. Three patients, children ten and twelve years of age, were completely cured anatomically. In eighteen cases there was considerable amelioration, with diminution in the size of the tumour and in the symptoms provoked by it. In ten cases the treatment failed completely. In none of the cases were toxic symptoms analogous to those which are seen in the thyreoid treatment observed, or any other symptoms of a toxic nature. An analysis of the cases observed by Dr. Reinbach does not enable us to say in which anatomical variety the thyreoid treatment has greater chance of success. It seems, however, that the effects of the medication are particularly appreciable in diffuse, simple, hyperplastic goître. On the whole, he says, the therapeutic results of the thymus treatment are very nearly identical with those of the thyreoid treatment. The former has, however, the advantage of not causing toxic symptoms, and for this reason it may be preferred to the latter treatment, and should be considered as the preferable method in cases in which the thyreoid treatment has not been efficient. Among the cases reported by Dr. Reinbach there was one in which the thymus treatment led to a successful result after the thyreoid treatment had completely failed.

Typhoid Thymus Extract.—In the *Deutsche medicinische Wochenschrift* for October 12, 1893, Dr. Eugen Fraenkel, of Hamburg, reported that he had treated fifty-seven cases of *typhoid fever* by the deep subcutaneous injection of thymus bouillon in which the typhoid bacillus had been grown and then killed. In the same journal Dr. T. Rumpf reported thirty cases treated by the dead cultures of the *Bacillus pyocyaneus* grown and prepared in the same manner as the typhoid cultures. These authors stated that half a cubic centimetre of either of these cultures, injected deep into the gluteal region, followed by the injection of one cubic centimetre twenty-four hours later, was, as a rule, followed by a slight rise of temperature, with or without a chill, on the third day a decided fall of temperature, not to be accounted for by the ordinary course of the disease, and on the following day a fall still more marked. If the temperature rose again, under a continuance of the injections in increasing doses at forty-eight-hour intervals, the patient in from six to eight days would be apyretic. The pulse came down to normal with the fall of temperature. No untoward symptoms appeared referable to the heart's action or to the lungs or kidneys. When a

chill accompanied the rise after the injections the heart's action did not increase correspondingly with the rise of temperature. Even when the fall of temperature was not complete, the fever changed from the continuous to the remittent type. Still more marked was the change in the general condition of the patient under the influence of the injections. The somnolence, stupor, and delirium disappeared; sleep became natural; the coated tongue cleaned; the diarrhœa disappeared, and the meteorism improved. The patients' appetite returned, and they complained of hunger, even though the successive crops of roseola continued and the spleen only slowly diminished in size. There was often profuse sweating with decided diuresis. This treatment, however, did not prevent complications or relapses, but when relapses did occur they quickly yielded to further injections. In some cases, however, the treatment was without effect. The earlier the stage of the disease in which it was begun, the better were the results obtained. It was effective in both severe and mild cases. Fraenkel makes no mention of his death-rate; Rumpf lost two patients out of thirty—one by intestinal hæmorrhage, the other by pneumonia.

The foregoing account of Fraenkel and Rumpf's experience is given by Dr. Alexander Lambert (*New York Medical Journal*, April 27, 1895), who, together with Dr. John Winters Brannan, proceeded to try the treatment in Bellevue Hospital. Dr. Lambert thus describes the preparation: The thymus glands of calves were obtained as soon after death as possible, chopped very fine, and mixed with distilled water, using for every gramme of the chopped glands two cubic centimetres of the water. This was allowed to stand in the ice box for from sixteen to eighteen hours, then strained through cheese cloth and squeezed out as thoroughly as possible. This gave a cloudy mucilaginous fluid, which was alkalinized with potassium hydroxide until not quite neutral to the phenolphthalein test, but distinctly alkaline to litmus. The fluid was then further diluted one third with water, and sterilized for half an hour in steam at 100° C. The fluid then became of a grayish-brown colour, and the coarse coagulated flocks were filtered off through absorbent cotton after the fluid cooled. The resulting fluid was of a milky, opalescent colour, and, being put in small flasks, was sterilized in steam at 100° C. for two successive days. These flasks were inoculated from a broth-culture of a typhoid bacillus obtained fresh from the spleen of a patient dead from typhoid fever. These flasks were then put into the thermostat at 37·5° C. and the cultures allowed to grow for seventy-two hours; they were then sterilized by heating in a water bath at 62° to 63° C. for from twenty to thirty minutes. They were then tested on agar plates, and, if sterile, were ready for use.

Twenty-eight cases were treated, including Dr. Lambert's and Dr. Brannan's in Bellevue Hospital, Dr. Northrup's in the Presbyterian Hospital, Dr. Norrie's in St. Luke's Hospital, and Dr. Draper's in the Roosevelt Hospital. Of these twenty-eight cases, fifteen showed more or less improvement, which could, Dr. Lambert thought, be fairly attributed to the injections. Twelve did not improve under the treatment, and one death occurred. In the fifteen cases showing improvement the injections were begun usually about the tenth day, ranging from the sixth to the fifteenth. At first in two cases it was tried as Fraenkel had suggested, by injecting half a cubic centimetre, and on the following day one cubic centimetre, then, at the expiration of forty-eight hours, if the temperature did not show a decided fall, two cubic centimetres; and then, if the temperature still remained high, repeating the injections at forty-eight-hour intervals, increasing the amount by one cubic centimetre at each injection. Under this plan the improvement was evident, but not marked. Therefore Dr. Lambert changed the plan of treatment, varying it somewhat in certain cases, but, as a rule, injecting increasing amounts for four or five successive days, beginning with a half or one cubic centimetre; then giving, at twenty-four-hour intervals, doses of two, three, or four, and then five cubic centimetres, as the case demanded; then waiting forty-eight hours, and, if the temperature rose again to 101° F. or over, repeating the five cubic centimetres, or even giving six or seven cubic centimetres. This gave much better results, as shown both in the temperature curve and in the general improvement of the patients.

In all cases the injections were made deep in the gluteal region, alternately on the right and left sides. In only one or two cases was there any local reaction, consisting of redness and tenderness, which subsided in one or two days. The temperature curve followed the description given by Fraenkel. Sometimes there was, within from thirty minutes to two hours after the injection, a rise of temperature with or without distinct chill, and at times this rise or this chill was followed by profuse sweating. In two cases the rise of temperature was accompanied with nausea and vomiting and headache. As a rule, after the third injection, the temperature curve showed a lower range, followed after the fifth injection by a decided fall of several degrees, even to normal, in the following twenty-four hours. The continuous type of fever curve often changed to the remittent type while falling. At times no abrupt fall occurred, but the fever ranged lower and gradually disappeared by a long lysis.

The pulse showed a decided improvement following the injections both in its frequency and in its force and tension. With the chill and rise of temperature after injections, as a rule, the pulse did not show a proportional increase in frequency.

The general condition of the patient showed the greatest improvement, the classical picture of the third week of typhoid fever being entirely absent. The mental condition improved; the patients lost their apathy and became bright, the sleep became more natural, the delirium ceased, and the diarrhœa stopped. When constipation was present instead of diarrhœa, the

injections had no influence whatever upon it. Marked hunger appeared in several cases coincident with the fall of temperature. The tongue usually cleaned and became moist before the use of the injection was completed. In one case, after the third injection, partial suppression of urine occurred, the patient passing only six ounces in twenty-four hours. This symptom disappeared in the following twenty-four hours, and the patient showed no bad effects from it. Five cases of relapse occurred in the sixteen cases favourably affected by this treatment. These relapses were not treated in every case with further injections, but those so treated quickly subsided. The roseola, however, was not affected, and the swelling of the spleen only slowly subsided.

In the twelve cases that showed no benefit from the treatment the injections were begun at a time varying from the ninth to the twenty-second day of the disease, averaging on the fifteenth day. This, says Dr. Lambert, is five days later than in the group of improved cases, and bears out Rumpf's statement that the earlier in the disease the injections are begun the more chance there is of a beneficial action. In three cases of this group where the injections were begun on the twentieth and twenty-second days of the disease the temperature fell rapidly after the injections, but it was so late in the disease that one can not be sure that convalescence would not have begun at that time had the injections been withheld. In the eight other cases there is no doubt, Dr. Lambert thinks, that the injections did not result in any benefit to the patients. On the other hand, in no one of the twenty-eight cases was there any harmful effect observed due to the injections. The case that proved fatal was a very severe one, the patient being in an extremely poor general condition when the injections were begun. On the eighth day but three injections were given of one, two, and three cubic centimetres, respectively; tub baths were also given during and after the injections in this case, but the patient died from the severity of the disease three days after the last injection, and on the fifteenth day of the disease. The cases recorded by Dr. Lambert were taken as they came to the hospitals, and were mild, moderately severe, and severe. The diagnosis was purely clinical.

Dr. Lambert cites von Jaksch, of Prague, as having used the original thymus bouillon of Fraenkel in nine cases and Rumpf's preparation in eight. In one severe case coming under his care in the second week, with a temperature of 104° to 105° F., after five injections with typhoid thymus bouillon the patient was apyretic and the temperature did not rise again. In the eight remaining cases so marked a result did not occur. It also was evident that with the pyocyaneus culture a continuous can be changed to a remittent fever, but in severe cases this result was not obtained. He did not obtain valuable results with the treatment, as he did not consider that he had so modified the typhoid poison that it proved of essential benefit to the patient, although he had shortened the duration of the disease. Moreover, the injections were unpleasant to the patients, as they often caused severe pain. In one severe case which came to autopsy, sterile pyocyaneus pus was found in the injection wound.

Kraus and Buswell, of Vienna, are also cited by Dr. Lambert as having tried the pyocyaneus thymus bouillon in twelve cases. They injected into the thigh and observed a limited lymphangeitis follow and abscesses in two cases. The cases were severe and moderately severe, without complications, but with two deaths. The stage of the disease was the second or third week, so far as the history could show. Only three cases showed positive results on the temperature. In four or five further cases such a supposition was fairly possible, in the rest it was quite out of the question. There was no influence on the curve as to the fever's being continuous or remittent. The pulse fell with the temperature; the diarrhœa did not improve, the roseola persisted, and the spleen continued large. Only one case showed marked general improvement, though it showed no marked fall of temperature. In this case there was distinct increase of strength, and the stupor and nightly delirium disappeared. These authors are not at all favourably impressed with the treatment.

In summing up the results in the cases recorded by him, Dr. Lambert says he certainly has not obtained the brilliant results alleged by Fraenkel and Rumpf. The treatment seems to him, however, to have been of benefit in a little more than half the cases tried, and where it benefited it certainly modified the severity, and in some cases shortened the duration of the disease.

THYRADEN.—This preparation, called also *extractum thyreoideæ*, consists of a dried extract of the thyreoid gland triturated with such an amount of sugar of milk that one part of the product is equivalent to two parts of the fresh gland. It is given in daily amounts of from 15 to 25 grains in cases in which thyreoid medication is indicated.

THYREOANTITOXINE.—Dr. Sigmund Fränkel, of Vienna (*Medical Record*, January 11, 1896), has given this name provisionally to a very hygroscopic crystalline substance, apparently an alkaloid, obtained by him from the thyreoid gland of the sheep and thought by him to be the active principle of the gland. So far as has been reported at present, it has been used only in experiments on animals.

THYREOID EXTRACT, THYREOID FEEDING, THYREOID GLAND, THYREOID MEDICATION, THYREOID TREATMENT.—During the past five years the attention of the medical profession has been strongly called to the therapeutic value of extracts made from certain animal tissues, many of which will probably soon pass into oblivion, while others will almost surely obtain a permanent position in our materia medica. It is by no means the first time in the history of medicine that healing virtues have been attributed to extracts made from animal tissues, for their use seems to have been known in a crude way among the ancient peoples; references are

made to them as well-known therapeutic agents in the Middle Ages, and during the last century a number were dropped from the London Pharmacopœia. But no such antiquity can be ascribed to the use of extract of the thyreoid gland, although it is to-day one of the most prominent of this class of drugs whose claim to recognition is based upon what appears to be a firm foundation. Its employment is essentially modern and was not due to chance or analogy, but was the result of careful scientific observation and logical deduction.

The history of its origin is very interesting. The function of the thyreoid gland had been a subject of curiosity for many years and various theories in regard to this function were held by different scientists, while some even made the assertion that in the adult human subject it performed no function whatever and was of no value. In 1873 the disease known as *myxœdema* was first described by Sir William W. Gull, and a number of autopsies have revealed atrophy of the thyreoid gland as a constant pathological condition in that disease. In 1883 Kocher described a condition called *cachexia strumipriva*, which occurred as a result of extirpation of the thyreoid gland, and a few months later Simon called attention to the identity of the symptoms of myxœdema and those of cachexia strumipriva. These characteristic symptoms are a subnormal temperature, a sensation of chilliness, mental and physical torpor, fibrillar muscular tremors, anæmiaa, subcutaneous deposit of mucin, and a thickened, coarse, dry, and harsh skin. After removal of the gland the subnormal temperature is preceded by an elevation of several degrees, and the cachexia appears the more quickly after the operation the younger the patient. The course of both conditions was marked by steady progress and usually resulted in death. A series of experiments upon the lower animals demonstrated that a similar condition was produced in them by the extirpation of the threoid gland.

It was next learned that the gland could be removed from the neck of a dog and transplanted to the peritoneal cavity, and that, if it became vascularized and attached in the place to which it had been transplanted, the animal remained free from the symptoms of cachexia strumipriva which otherwise invariably supervened. Attempts to transplant the thyreoid gland of a sheep into the tissues of patients suffering with myxœdema followed as a natural sequence. In 1890 Bettencourt and Serrano performed this operation and obtained a great improvement, which began at once, before the gland had had time to resume its functions, or indeed to become vascularized. This demonstrated that something of a remedial nature had been introduced into the system which *per se* had caused the improvement, and the most reasonable explanation appeared to be that this something was present in the juice of the gland, as this had escaped freely into the tissues of the patient during the operation, where it could readily have been absorbed. Further experiments on the lower animals also showed that the appearance of cachexia strumipriva could be prevented after thyreoidectomy by the systematic injection of the fresh juice of the thyreoid gland. Thus all other theories of its function were done away with and it was evident that the thyreoid gland produced something necessary for the nutrition of the body and that this something was apparently to be found as a secretion in the juice of the gland. These questions then immediately arose: Could this substance be isolated, and could it be utilized as a therapeutic agent? A number of investigators have attempted to accomplish the isolation of this substance, and the reports thus far published seem to promise some definite result in the near future, although at the present time of writing we have little or no knowledge of its chemical nature; but the second question was quickly answered in the affirmative.

On April 13, 1891, G. R. Murray gave for the first time a hypodermic injection of a glycerin extract of a sheep's thyreoid gland to a patient suffering from myxœdema, and after the maintenance of this treatment for a reasonable length of time was gratified to observe a decided improvement. In the early part of 1892 several successful attempts were made to administer the thyreoid gland by the mouth, in either a raw or a cooked condition or in the form of an extract, which demonstrated that the active principle secreted by the gland was not destroyed by the process of digestion, and since that time it has been employed by the profession to a considerable extent. An important factor doubtless in the cordiality of its reception is the fact that the cases for which it is recommended and in which it accomplishes the most good are of the number which before were acknowledged to be hopeless and incurable. They are also rare, fortunately, in this country.

Our knowledge of the physiological action of the secretion of the thyreoid gland is very limited and consists only of what has been observed of the symptoms produced by its absence and those produced by larger doses than necessary given to patients suffering from certain pathological conditions. The symptoms produced by its absence from the system are those of myxœdema and of cachexia strumipriva, and the study of these has given rise to theoretical explanations which are as yet attended with so much uncertainty that the only definite statement which can be made is that the thyreoid gland performs an important part in the nutrition of the body. The usual symptoms which have been noticed after the administration of a dose too large for the patient to tolerate are a sharp rise of the temperature, an increase in the rapidity of the pulse, headache, nausea, vomiting, prostration, and profuse perspiration. The gastro-intestinal disturbance is apt to be severe, and one case is recorded which terminated in coma and death. A case reported by Béclerc seems to be particularly instructive because the ingestion of a large amount of thyreoid gland was persisted in for several days, and the symptoms which were induced bore a remarkable resemblance to those present in exophthalmic goître. The patient, who was suffering with myxœdema, is

said to have taken nearly three ounces (92 grammes) of thyreoid gland in eleven days and to have presented the following symptoms at the end of that time: Rapid pulse and respiration, elevation of temperature, restlessness, insomnia, the presence of both albumin and glucose in the urine, which was greatly increased in quantity, exophthalmia, a sensation of heat, profuse perspiration, partial paraplegia, and temporary tremor of the arms. Other authors have also observed symptoms which occur in exophthalmic goître occasioned by the prolonged use of a greater or less excess of thyreoid extract in cases of myxœdema, and this has occurred to such an extent that it is alleged that with the exception of those symptoms referable to the motility of the upper lid, von Graefe's and Stellwag's symptoms, and those due to swelling of the thyreoid gland, all the common and many of the less frequently observed symptoms of exophthalmic goître have been thus produced. Swelling of the salivary glands has also been reported as a result of overdoses.

For medicinal purposes the thyreoid gland of the sheep is usually employed, but that of the pig or of the cow may be substituted with equally good results. The animal from which the gland is taken must be in perfect health, and that this is the condition should be determined by a thorough and careful examination of its various organs. The gland should be removed with complete aseptic precaution, freed from fat and connective tissue, and then placed in a sterilized jar. It may be eaten raw or very slightly cooked, but, as the flavour is not pleasant, it is advisable to give it in glycerin or some other vehicle to disguise its taste whenever this method of administration is for any reason preferable.

A better form for administration is the liquid extract, which may be prepared in the following manner: The gland is finely minced and the fragments, together with the fluid which escapes during this process, are placed in a mixture of equal parts of boiled water and glycerin, in the proportion of two cubic centimetres of the mixture to each lobe of the gland, in which they are allowed to macerate in a cool place for about twenty-four hours. The preparation is then filtered under pressure, and usually yields about a drachm and a half of extract obtained from one entire gland. In the earlier preparations a 0·5-per-cent. solution of carbolic acid was used instead of boiled distilled water, but this is not necessary. This extract was at first used hypodermically and may still be so given, but it is quite apt to cause localized inflammation and abscesses, and, as the process of digestion does not appear to affect the active principle, it is preferable, unless there is a special contra-indication, to give it by the mouth. When given hypodermically, it must be injected very slowly and in much smaller doses than when swallowed. It deteriorates after a few days, so fresh preparations must be frequently made.

A more elegant and on the whole more satisfactory preparation is the dry extract, which is made by pulverizing the gland or the expressed juice after it has been dried, or from precipitates thrown down in the liquid extract by alcohol or other reagents. This dry extract, mixed with proper excipients, is on the market in the form of tablets and pills which are stated by the manufacturers not to be liable to deteriorate for a considerable length of time, and form the most available and best form of the drug for administration.

[Dr. S. J. Meltzer (*New York Medical Journal*, May 25, 1895) says concerning the thyreoid preparations: "We can hardly speak any more of thyreoid extracts. In this country the preparations of three firms seem to be in vogue—Parke, Davis, & Co., Armour & Co., and the London firm of Burroughs, Wellcome, & Co. The latter offer the thyreoid exclusively in the convenient form of tablets. In the English and German literature we often read of these tablets; in this country also they are preferred by some. My own experience has been less favourable—the effect was inconstant. Of Parke, Davis, & Co.'s preparations, I have employed so far only the desiccated powder. In the myxœdema case that I reported to you (the members of the German Medical Society of New York) last year I had again and again to return to the powder of Parke, Davis, & Co., which always brought the desired effect. Of Armour's preparations, I have used both the powder and the tablets. The latter have not given me satisfactory results. The tablet form is not reliable, anyhow; they often do not dissolve, and then again it might happen that an accumulated large number would accidentally dissolve at once and produce a dangerous condition. The powder is furthermore preferable because you can prescribe different quantities at your own will, while fractions of the small tablets can certainly not be measured exactly. The powder is administered in wafers or in capsules, if it is simply put into the capsules without being previously made into a mass. It should be borne in mind that the weights of the preparations of the different firms have a different meaning. Parke, Davis, & Co. prepare fifteen grains of powder from one thyreoid, while Armour & Co. prepare only six grains. Thus one grain of Armour & Co.'s powder is equal to about two grains and a half of the powder of Parke, Davis, & Co. For the tablets of Burroughs, Wellcome, & Co. it is maintained that they represent one sixteenth of a thyreoid and contain five grains of the substance of the gland. Then one tablet would be about equal to one grain of the powder of Parke, Davis, & Co., and from an eighth of such a tablet Bramwell has seen good results!" Dr. Meltzer adds in a foot-note that tablets similar to those of Burroughs, Wellcome, & Co. are now furnished by Fairchild Brothers & Foster.]

The indications for the use of thyreoid extract may be briefly stated to be the symptoms caused by the absence of the normal secretion of the thyreoid gland from the system. Its therapeutic value is chiefly exhibited in the treatment of *myxœdema*, where it appears to supply a substance of which the system has been deprived by the functional inactivity of

the organ by which it is normally secreted. The results which have been obtained in this heretofore incurable disease have been peculiarly gratifying whenever the treatment has been maintained for a sufficient length of time. Among the earliest signs of improvement are the rise of the temperature to normal and the disappearance of the feeling of chilliness. These are apt to occur during the first week of treatment. The swelling then begins to decrease, and care should at this time be exercised to prevent a too rapid diminution in weight, as this may occasion prostration. The skin undergoes a certain amount of desquamation and then begins to regain its normal condition. At first it may hang loose on the body, because it has been stretched to a considerable degree by the swelling, but it gradually regains its elasticity and contracts, while at the same time it loses its harsh, rough appearance and becomes soft and moist. After several months of treatment a new growth of hair replaces that which had fallen out and the nutrition of all parts of the body is greatly improved. The lessened hebetude and the gradual increase of physical and mental energy are among the early symptoms of improvement, and they progress about equally, while the speech improves until it is fluent and distinct.

The treatment of myxœdema is divided into two stages, the first to remove the symptoms, the second to prevent their recurrence. The duration of the first stage is uncertain, but may be said to be several months, while that of the second will probably be for the remainder of the patient's life. The dose of the extract at the beginning of treatment has to be determined for each case individually. Murray says with regard to the liquid extract: "If a dose of five minims of the extract is given each morning two or three hours after breakfast and no distinct improvement has taken place at the end of a week or ten days, and the pulse has not been accelerated, the dose should be increased to ten minims and later to fifteen if ten is not found to be sufficient. In some cases it is necessary to give as much as fifteen minims twice a day." The pulse, temperature, and digestive organs must be watched for signs of intolerance. An increase of the pulse-rate of more than twenty beats a minute, a rise of temperature to a degree above normal, or any gastro-intestinal disturbance should be noted as an indication that the dose is too large and must be reduced. During the second stage the object is to furnish the exact amount for the daily need of the body, and this likewise can be determined only by experiment.

[When the manifestations of myxœdema have once been subdued it is important to know when to resume the thyreoid treatment. On this point Dr. Meltzer (*loc. cit.*) remarks that it is generally stated that an increase in weight is an indication to start the treatment again, but this he thinks is certainly not correct for all the cases. An increase in weight is often observed while the patient is still continuing to take the thyreoid in full doses, especially after the first rapid loss in weight; the improved health is the cause of gaining normal flesh. He has seen it in his own experience, and similar statements are made by others. He would rather put forward the complaint of *feeling cold* as a sure indication of the beginning of the return of myxœdema. He has noticed the appearance of this complaint sometimes even before the weight has shown an increase, and a few small doses of thyreoid were sufficient to soon do away with the chilliness. The chilliness is an important symptom in myxœdema, and is independent of the changes in the skin or the subcutaneous tissue.]

Thyreoid extract is an efficacious remedy in *cretinism*, which seems to be simply a variety of myxœdema that appears in infancy or early childhood and is in like manner dependent on a faulty development, atrophy, or functional inactivity of the thyreoid gland. The improvement is in the same manner and on the same lines as in myxœdema, with results which are equally gratifying. On account of the arrest in their development, children who suffer from cretinism are very small, and a noticeable effect of this treatment is the rapidity of their growth after they have come under its influence. These children are able to take much larger doses of thyreoid extract in proportion to their size than myxœdematous adults, but too large doses produce the same class of symptoms. As in myxœdema, the administration of the remedy must be prolonged throughout the patient's life, and it has been suggested that on this account grafting of a thyreoid gland into the neck may prove the preferable method of treating this condition.

[In *Pædiatrics* for May, 1896, Dr. Frederick Peterson and Dr. Pearce Bailey report a case of cretinism, in a child eighteen months old, as probably cured by thyreoid treatment, also another, in a subject fifteen years old, as greatly improved. They have tabulated the cases reported up to the time of preparing their article, in so far as the reports were sufficiently specific to be of statistical value. They conclude that under thyreoid treatment the symptoms of myxœdema disappear from the child quite as readily as from the adult. In none of the cases cited by them did the general œdematous symptoms fail to yield to the remedy when it was properly and sufficiently applied. The skin became soft, the swellings disappeared, and the whole appearance of the patient was completely changed. The carrying out of the treatment of myxœdema, they remark, is attended with fewer difficulties and dangers in children than in adults. Toxic symptoms have been observed in a few cases only, and but two patients have died under treatment. Of these, one died of intercurrent diphtheria and one of bronchitis; in neither of these two cases was the treatment regarded as a causative factor of the fatal symptoms.

In addition to the disappearance of the symptoms from the skin and subcutaneous tissues, the thyreoid treatment of sporadic cretinism has in some cases led to brilliant results by permitting a return of development and growth to children in whom these func-

tions had been limited or arrested by the disease. But although marked changes in the mental and physical condition of cretins have occurred, it yet remains to be reported, they add, that these children become the physical and intellectual equals of children who have never had myxœdema. Improvement consequent upon a return of development has been more constant in the body than in the brain. In a large number of the reported cases the patients have grown considerably taller and have acquired sufficient power and control of the limbs to enable them to walk, which had previously been impossible. The teeth, which had been absent or defective, began to appear normally.

Intellectual progress has been neither so constant nor so rapid. In nearly all the cases there has been noted some mental improvement, but in only a few has the power of speech been acquired when it previously had been absent. They remark that the occurrence, in the formative period of infancy and childhood, of a disease which attacks nutrition, development, and growth fundamentally has much more disastrous effects than when its appearance is delayed until the organism has reached maturity. They think that, while it is possible that the removal of causes inhibitory to growth may result in a gradual return of developmental processes, the thyreoid treatment of infantile myxœdema has in no case been carried out for a sufficient length of time to permit of the assertion that such will be the case. They have been able to find no case in which treatment is reported to have lasted more than a year and a half, and of no case is it said that the patient was in all respects cured; but from the fact that in nearly all the cases treatment was not instituted until the child was several years of age and had developed but little or not at all for a considerable length of time, several years would be necessary, by the natural processes of development, for the complete re-establishment of normal growth.

Although data sufficient to justify positive assertions are lacking, it seems to them entirely within the range of possibility that, if the treatment of sporadic cretinism is begun at the outset of the disease, before growth is seriously interfered with, it will permit of the proper development of the child, without myxœdematous symptoms, as long as the thyreoid is administered.]

Insanity is not a rare complication of myxœdema. It usually occurs in the form of acute or chronic mania, melancholia, or dementia, and is quite amenable to treatment with thyreoid extract.

[Thyreoid treatment has been employed successfully in some cases of insanity not connected with myxœdema. Dr. Lewis C. Bruce (*Journal of Mental Science*, January, 1895; *Dublin Journal of Medical Science*, August, 1895) concludes a clinical article on the subject as follows:

1. By the internal administration of thyreoid-gland substance a true febrile process can be induced, and the resulting reaction is beneficial to the patient. 2. The amount of the drug necessary to induce physiological action varies in different individuals, but it is seldom necessary to give a larger dose than sixty grains daily. 3. Excessive and prolonged administration of thyreoid extract produces gastric irritation. 4. The use of thyreoid extract in the treatment of the insane is accompanied by a certain amount of danger from induced heart weakness. This danger can be minimized and almost discounted by confining the patient to the bed during treatment and for some days afterward. 5. The administration of thyreoid is contra-indicated in cases of mania where the excitement is acute and the loss of weight rapid, and where there is danger of exhaustion from malassimilation of food. 6. Thyreoid treatment appears to be specially useful in the insanity of the adolescent, climacteric, and puerperal periods. 7. It is especially useful in cases where recovery is protracted. 8. In cases of long standing, where there is a tendency to drift into dementia, a course of thyreoid treatment sometimes gives the necessary fillip which leads to ultimate recovery. 9. Patients under this treatment should be kept in as equable a temperature as possible.

The use of thyreoids in the various forms of mental derangement has been made the subject of special investigation in three of the New York State hospitals for the insane, says a writer in the *International Medical Magazine* for May, 1896, and the results are published in the *State Hospitals Bulletin* for January, 1896. In the Middletown State Hospital (homœopathic), Dr. Ales Hrdlicka has used thyreoid tablets in four cases of *general paresis*, one case of *suicidal melancholia*, one of *primary dementia*, one of *dementia following acute melancholia*, one of *puerperal insanity*, one of *paranoia*, and three of *secondary dementia*. All these patients were free from respiratory or circulatory disorder. The treatment extended over two months and was begun with the administration of 5 grains daily, and the amount was gradually augmented to 25 or 30 grains daily. Among the effects of the drug the following are recorded: Both the pulse and respiration were increased in frequency, but this increase was never great. There was a rise in temperature of one or two degrees. The appetite improved. The bowels were regulated, and in several cases diarrhœa was produced. The elimination of urea was increased. The majority of patients lost weight while under treatment. Regarding the mental symptoms, there was noted, under moderate doses, pronounced general psychical improvement; the mind became clearer and more active, and the manner livelier. Sleep was improved. When the dose was immoderate, symptoms of irritation appeared as a rule. The patient with puerperal insanity was cured. In the case of suicidal melancholia, in that of dementia following melancholia, and in two of the cases of secondary dementia there was temporary improvement. The 'patient with primary dementia grew worse. There was some temporary amelioration in a few of the cases of general paresis.

Dr. Warren L. Babcock experimented with desiccated thyreoids at the St. Lawrence State Hospital with three main objects in view: first, to definitely ascertain the physiological action of thyreoid; second, to determine thereby in just what classes of cases it might be used to further recovery; third, to apply it therapeutically to those cases in which it offered the best results. This observer determined that extracts made from the thyreoid gland had a definite physiological action; that an unvarying strength of any given amount could be obtained by proper preparation; and that the true thyreoid preparations had no relationship with the so-called animal extracts. The treatment was begun by the administration of 5 grains of desiccated thyreoid extract, and this dose was increased judiciously. Fifteen grains seemed to be the maximum dose that could be given with safety for any length of time, and then only in patients whose physical health was impaired in a slight degree if at all. The physiological action of the drug he sums up as follows: The number of red blood-corpuscles to the cubic millimetre and the percentage of hæmoglobin were increased. In the majority of cases arterial tension was increased; in a small proportion the blood-pressure was diminished. Præcordial oppression occurred in a few cases. The pulse was accelerated; the respirations were not especially influenced. The temperature in the majority of cases was elevated from one to three degrees. In one case the temperature was subnormal. Myasthenia was pronounced in the majority of cases at an early period of treatment; flaccidity, tremor, and general weakness characterized these cases. The early development of a feeling of apprehension, together with some mental and much motor restlessness, was noted, usually during the third day. At first there was an apparent sense of fatigue with great mental oppression, followed by a gradual clearing up of the cerebral processes and improved mental co-ordination. The reflexes, in the majority of cases, were increased and exaggerated from an early period of the treatment. In nine cases presenting more or less anæsthesia, the sensibility returned to normal or was very much improved. Two patients became hyperæsthetic. Diuresis was well marked in many cases, and perspiration was decreased. A few of the cases presented varying degrees of gastric symptoms. An eruption accompanied by severe itching like urticaria, and followed by scaling and desquamation, was observed in two cases. The elimination of the products of retrograde metamorphosis was greatly increased. Dr. Babcock thinks that the thyreoid treatment holds out a prospect of recovery or improvement, first, in cases of post-melancholic hebetude following a lengthy period of depression; second, in cases of stuporous melancholia of long duration; third, in maniacal cases in which the attacks have been unduly prolonged; fourth, in cases of cerebral exhaustion following acute delirium or stupor in which the elimination of urea and other nitrogenous compounds is greatly reduced: fifth, in chronic "disturbed" cases; sixth, in doubtful cases thyreoid may assist in distinguishing between true stupor and dementia; in delusional cases it will show whether the delusions are fixed or temporary.

Dr. L. Pierce Clark, of the Craig Colony for Epileptics (*Medical Record*, October 24, 1896), has employed thyreoid treatment in *epilepsy*.

The cases selected were those in which many congenital defects were noticeable, and in which epilepsy had been a prominent feature of the patient's life since early infancy. An effort was also made to select cases in which defective development mentally as well as physically was manifest. The treatment was not attended with very good results. While all the patients seemed to be benefited for the time being in some ways, Dr. Clark doubts if there will be any permanent improvement. On the whole, he says, its small effect upon epileptic seizures in these trial cases would not seem to justify its continued use in epilepsy, and its further administration has not been attempted.]

Attention has been directed to the use of thyreoid extract in *skin diseases* by Byrom Bramwell, who in 1893 reported excellent results in a number of cases of *psoriasis* treated in this manner, and since then it has been tried rather extensively in the treatment of various cutaneous diseases. The results can not be said to have been marked with great success, but improvement has been obtained in a sufficiently large number of cases to warrant further investigation. The good results sometimes obtained from the use of thyreoid extract in these cases suggest the question of whether it is not possible that certain forms or cases of cutaneous disease are dependent upon some irregularity or perversion of the thyreoid secretion, and whether the artificial ingestion of its active principle for a time may not enable the gland to regain a healthy activity and cause the symptomatic cutaneous eruption to disappear. At present a distinction can not be made between the cases which will and those which will not be benefited by this treatment.

[In the *New York Medical Journal* for May 4, 1895, Dr. Leo Stieglitz reported the cases of two sisters affected with *deformity of the nails* that he had treated with thyreoid feeding. In the case of the older sister, a cook, twenty-two years old, the nails in which the disease was most advanced were of a brownish hue, "as if mortified"; they were rough, irregular, misshapen, short, and stunted, as if retarded in their growth. The disease, where it was less pronounced, involved only part of the nail in longitudinal section, the diseased part being brown and occasionally separated from the healthier part of the nail by a longitudinal split. The nails least affected were rough, brittle, and mottled in appearance. The skin of the hands was rough to the touch and slightly puffy. The growth of hair on the head and other parts of the body was abundant. The skin of the face and body was not abnormal in any respect. The nails of the toes showed the same diseased condition as those of the fingers. A careful examination of the nervous system and of the various viscera re-

vealed no disturbance of any kind. The patient was put upon the use of 5 grains of Parke, Davis, & Co.'s desiccated thyreoids, once a day the first week, the second week twice a day, and subsequently three times a day. At no time were any ill effects from the use of the drug noticeable. In four weeks after the beginning of the treatment the patient began to shed her nails and some of her hair. In two months more a set of new, well-developed, smooth, and shapely nails had replaced the old diseased ones. The skin of the hands became smooth and soft. The loss of hair was followed by a more luxuriant growth than had been present before. The patient was presented in this condition to the New York Society of German Physicians on February 23, 1894. She subsequently stopped taking thyreoid for a few weeks, and her nails began to show signs of returning disease, which disappeared when the treatment was taken up again, 5 grains being given every day or two.

The younger girl, seventeen years old, had the nail of her right thumb affected in the same way that her sister's nails were; it was brown, rough, thickened, and stunted in its growth. The girl had worked for a year and a half in a gold factory, where she often had to put her thumbs into a solution of ammonia. For six months she had not been working. She had noticed the change in her right thumbnail for a year; none of the other nails were affected. The thyreoid preparation was administered in a 5-grain dose once a day, but it caused so much nausea that the patient stopped the treatment after a few days. During the next nine months the condition of the nail remained unchanged, the nail not growing at all, according to the patient's statement. On December 5th she began taking Burroughs, Wellcome, & Co.'s 5-grain thyreoid tabloids, one a day, and continued to do so up to the time of the report, the tablets creating no disturbance of any kind. Within a few days the nail began to grow, and on December 23d it was already half renewed, the new part being somewhat uneven, but of proper colour and consistence.

The girl was shown by Dr. Stieglitz at a meeting of the Manhattan Medical and Surgical Society on December 29th, and it was seen that the contrast between the healthy and diseased portion of the nail was striking; whereas the proximal half was healthy in colour and consistence, though uneven, the distal half was brown, brittle, and stratified. These two cases show, says Dr. Stieglitz, that even in the absence of myxœdema thyreoid feeding stimulates the growth of the nails to a remarkable degree.

In the same article Dr. Stieglitz reports a case of *circumscribed sclerodermia* of the leg, in a woman thirty-three years old, in which the condition was much improved by the use of 5 grains of Parke, Davis, & Co.'s desiccated thyreoid gland from once to three times a day, but he does not maintain that thyreoid treatment will cure sclerodermia.

In the *British Medical Journal* for April 18, 1896, Dr. William Rushton Parker relates a cure of *eczema* with thyreoid extract as follows:

"Mrs. K., aged sixty-five, mother of fifteen children, had been hale and active all her life. Between 1890 and 1895 she became very much stouter, and a very conspicuous bagginess developed under the chin. During the summer of 1895 her appetite failed, she became weak and lazy, and lost much of her recent accumulations of fat. In October eczema appeared over the whole surface, so that by November the scalp was very dry and scurfy, the hair lustreless and sparse; the trunk dry and rough all over, swollen and erythematous in parts, and much torn by scratching; the upper limbs dry and harsh, with erythematous patches in the bends of the elbows; the lower limbs red, greatly swollen, moist, and much excoriated, worse below than above the knees, and itching severely. As the patient always felt cold, notwithstanding the mildness of the winter and her remaining in bed near a blazing fire night and day; and as she had this baggy myxœdematoid swelling under the chin, with some suspicion of similar masses above the clavicles in the lower part of the posterior triangles, and as the entire surface had by the middle of December become dry and harsh by a few weeks' local applications to the legs, she was put on a 5-grain thyreoid tabloid daily for two weeks, and two tabloids daily in January, with the result that the chilliness vanished, the submental bagginess decreased, and the entire skin was rapidly losing its dryness, roughness, and itchiness, and becoming quite natural. She then discontinued the tabloids, when the eczema returned so badly as to be very little better in the latter half of January than in the previous November or early half of December. During February she was put on three, and afterward four, tabloids daily, when the chilliness again disappeared, the submental bagginess decreased, and the whole surface rapidly lost its dryness, harshness, and itchiness, the skin becoming so fine and soft that the tabloids were discontinued in the beginning of March without any recurrence of the eczema during the six subsequent weeks that the patient was under observation.

"There was no suspicion of true myxœdema beyond the bagginess, chilliness, and dry skin; the patient was garrulous, and her mind as clear as ever, except for a problematical blunting of memory. The thyreoid extract was given more on account of these symptoms than for its reputed usefulness in psoriasis and eczema; and the total disappearance of the eczema under its administration was an agreeable surprise. It should be added that the eczema rubrum of the legs was treated with lead lotions, calamine ointments, and bandaging; while quinine, strychnine, iron, and arsenic were given for the loss of appetite, weakness, and *malaise;* but no marked difference was observed on passing from one to another tonic at all corresponding to the obvious changes which kept pace with the variations in thyreoid extract."

Dr. J. Barclay (*British Medical Journal*, October 24, 1896; *New York Medical Journal*,

November 14, 1896) calls attention to the results obtained by him in the treatment of *lupus* with thyreoid extract, but adds that the slight extent of his experience does not, he thinks, entitle him to be dogmatic as to results. He relates the histories of four cases. The first patient was an unmarried woman, aged twenty-five years, who had been the subject of lupus of the nose and both cheeks since 1891. Scraping had been thoroughly done in 1892, and, on the disease returning, scraping and Paquelin's cautery were employed in 1893. Relapse soon followed, and in January, 1895, thyreoid tabloids, one three times a day, were given. In three weeks local reaction became apparent, very markedly resembling that following Koch's tuberculin in this disease. First there appeared a bright-red ring surrounding each nodule, with swelling of the nodule and tenderness, indicating acute inflammation. The dose was now increased to six tabloids daily, and after a couple of weeks nine were taken. These were well borne, nothing worse than emaciation being observed during the months of the treatment. This condition of inflammation persisted for several weeks, at the end of which the nodules began to soften and break down. Complete sloughing followed, and a deep ulcer took the place of the nodules. At this stage all the surrounding redness had disappeared. After all the nodules had pursued this course of inflammation and consequent necrosis, the parts previously affected presented a series of clean and healthy-looking sores, from which a thin discharge exuded. Healing was slow. Yet by merely keeping the parts clean by washing with soap and water, and by covering them with vaseline to prevent the formation of scabs, healing was gradually accomplished, and there remained only a white, flat, and sound scar. No other external application than vaseline was employed. Dr. Barclay regrets that the discharge from the ulcers was not examined for bacilli, and that no note of the temperature during the stage of inflammation of the nodules was kept. In September, 1895, it was noted that the face was nearly well, and in January, 1896, quite well. At the date of the report—July 16, 1896—the face remains quite well.

In another case the patient was a married woman, aged thirty-five years. She had been the subject of extensive lupus of the face since 1889. The disease included a large patch on the right cheek, one on the upper lip, and the whole of the nose and interior of the nostrils. Various attempts at destruction of the malady had been made before the author saw her, which was in April, 1891. At that time a thorough scraping was done, but the disease returned more actively than before. Cod-liver oil was taken from that time to the end of 1892, but without apparent benefit. In February, 1893, scraping and Paquelin's cautery were followed by temporary benefit, but after a few months matters were as bad as before. In January, 1895, thyreoid tabloids were ordered, but were taken very irregularly, and sometimes ceased to be taken altogether for weeks at a time during all that year. On all the occasions on which the medicine had been continuously taken for three or four weeks, the usual local reaction, which is described as having occurred in the preceding case, was observed—namely, redness, swelling, and pain; but immediately on leaving it off these local signs gradually died away, and no necrosis or sloughing of the nodules followed. However, in January, 1896, the patient took the tabloids in earnest, first three daily, after a fortnight six, and after a month nine a day. The result was that the whole of the nodules on the nose sloughed away, the deep ulcers left have become filled up, and cicatrization is going on steadily. The patch on the right cheek, which had somewhat healed over before the thyreoid treatment was begun, had become inflamed, but no necrosis followed. The nodules on the upper lip, which all along had been larger than those on the nose, seemed to have been more slowly affected by the thyreoid than the others, and at this time all had not softened down *pari passu* with their neighbours. At the time of the report she was continuing to take the medicine steadily. The only external application employed was vaseline.

The whole process of the local reaction following thyreoid treatment, says Dr. Barclay, is very similar to that which we were accustomed to observe after tuberculin injection, with this difference, that the thyreoid reaction is less violent, both locally and constitutionally, and the good effects will, he trusts, be more complete and more permanent. He refers to Mr. Jonathan Hutchinson as remarking, speaking of the treatment of lupus by Koch's method: "No one ventures to report an instance of complete cure. Of the cases which have been shown to me as the most satisfactory, I am bound to say that in every one there has been evidence at some part of the edge of the remains of lupus tissue ready, I do not doubt, to start into fresh growth on the slightest provocation." Time and experience, continues Dr. Barclay, have shown the truth of this statement. Judging from these two cases, there is in them no such suspicious appearance up to the present time. As to the duration of the treatment necessary to insure a permanent cure, even with full doses given regularly and continuously, it would seem as if one could not trust to a complete cure being effected in a shorter time than a year. The dose of the medicine in lupus, as in psoriasis, requires to be larger than what is found sufficient for myxœdema. And, as regards the age of the patient, the older he or she may be, the more cautious ought we to be with the quantity prescribed. Dr. Barclay states that he has observed no serious effect in youthful patients, but in those who have passed fifty years of age some irregularity of the heart's action has been noticed, which is controlled easily, however, by reducing the dose and giving some alcoholic stimulant. Some interesting questions, he thinks, might arise in the course of this treatment. For instance, he asks, would it not be prudent during the necrotic stage of

the nodules periodically to examine the discharge for bacilli? Valuable information as to the progress of the treatment might thereby be obtained. Then one might ask what would be the effect of a similar treatment in tuberculous glands in the various situations in which these are found? Would it be analogous to what he has described in lupus? And, lastly, what would be the probable effect of this treatment in tubercle of the lungs?

Surgeon-Major C. B. Maitland, I. M. S. (*Lancet*, October 31, 1896), gives an account of two cases of *leprosy* in which he employed thyreoid treatment. One of the patients was a Mussulman and the other a Hindu. He remarks that the thyreoid gland certainly had a beneficial influence on these two men. There was obvious improvement in the skin, as shown by the effect on the tubercles and the ulceration. There were no symptoms of thyreoidism, although the Hindu was taking two glands daily from June 3d to September 15th. The glands were pounded up raw with sugar and water. These cases are interesting, says Mr. Maitland, as showing that the thyreoid gland certainly has some effect on leprosy even when given to patients who continue their usual home life while undergoing treatment.]

Our knowledge with regard to the efficiency of thyreoid extract in cases of *obesity*, *anæmia*, *acromegaly*, and *syphilis* is very slight. In some of these diseases this treatment has been suggested on purely theoretical grounds, while of others a few cases have been reported; but more extensive investigations should be made in regard to all before any conclusions are drawn.

[In an excellent article entitled Thyreoid Therapy (*Medicine*, August, 1896), Dr. James B. Herrick, of Chicago, remarks that the rapid loss of weight that occurs in myxœdema when the remedy has been employed, suggested its use in *obesity*, and the results warrant a trial in all cases. Kraus, he adds, finds thyreoidin of greater value in anæmic obesity than in that form accompanied by rosy lips, ruddy cheeks, good appetite, and strong muscles. In all cases the action on the heart is to be watched. The diet may or may not be altered. Where great tendency to weakness is shown, a full nourishing diet should be allowed during the treatment. Relapses are common unless moderate doses are continued. Among those cited by Dr. Herrick as giving favourable reports are Davies, Leichtenstern, Wendelstadt, Dercum, Barron, and Ewald. Losses in weight, even up to nearly 25 pounds in six weeks, are reported, according to Dr. Herrick. Ewald, he says, has found that thyreoiodinin answers fully as well in promoting reduction of weight as the entire gland does. Just why some cases are refractory and others amenable, says Dr. Herrick, is still not definitely settled.

The following account of an interesting case of *acromegaly* treated with thyreoid extract, by Dr. G. G. Sears, of the Boston City Hospital, was published in the *Boston Medical and Surgical Journal* for July 2, 1896:

"Mrs. C., a widow, forty-five years old, first presented herself for treatment at the Boston City Hospital in January, 1895. Her maternal grandfather died insane; her father of a 'complication of diseases,' probably of cardiac origin, at the age of fifty; her mother of apoplexy at seventy-one. She has lost two brothers from consumption, while one brother, when last seen several years ago, had a brownish discoloration of the skin similar to that of the patient herself, and was 'all bloated up.' She has had three children, none of the labours being noteworthy, one of whom died of cholera infantum; the other two are well but not strong.

"Her previous medical history consists of an attack of varioloid when eight years old, erysipelas when eighteen, and pneumonia when twenty. Five years ago she had an attack of grippe accompanied by severe pain in her left ear. She has had occasional attacks of cholera morbus, and has been under treatment for retroversion of the uterus and a lacerated cervix. She reached the menopause about six months ago, but had been irregular for about a year. Her general health has always been good, but she has complained all her life of drowsiness, which in recent years has so increased that now she is liable to drop asleep at any time. With this exception she dates all of her symptoms from twelve years ago, when a flat-iron fell upon her left side, starting up a brisk uterine hæmorrhage, which lasted, however, but a short time. The nervous shock was much greater than the physical injury, and after this she passed large quantities of urine and had attacks of sudden weakness, in which she fell but yet retained consciousness. She began also to be very susceptible to cold, so that she had to wear extra flannels and take hot-water bottles to bed with her even in summer. Lately this symptom has grown decidedly better, and she now complains chiefly of local chilly feelings with the appearance of 'goose flesh' in spots about as large as a five-cent piece. Soon after the accident she noticed that her hands and feet were increasing in size, so that while she once wore a 3½ shoe she now requires a broad 7, and instead of a 6½ glove she now wears a 7½, while her tongue has become so large that it is frequently bitten, and at times 'feels so big that she wonders whether or not she can thrust it out of her mouth.' Her face grew fuller, her nose more prominent, and her hair coarser and drier, but it has never fallen out and still hangs nearly to her knees. She has suffered intensely at times, especially at night after sweeping or washing, from a feeling of numbness in her hands, which is accompanied by itching, pain, and a sensation of pins and needles. Her body also has at times felt sore and tender all over, and on lying down her joints become so rigid that she moves with difficulty, while on rising her knees are so stiff that the first few steps are hard to take. She has had frequent attacks of cardiac palpitation as well as very distressing hot flashes recurring every ten or fifteen minutes. Sweating, especially at night, and most noticeably over the chest, has also been a fairly constant symptom. Every little while she hears a 'puffing' in her ears synchronous with the heart and lasting for a longer or shorter period, but which for a

day at a time may be nearly constant. About five years ago she lost her husband after a very long and trying illness, and after this she noticed that her mental processes seemed slow and that her memory was greatly impaired, so that she would often begin a sentence and then forget what she was about to say. She also became unusually nervous and irritable over trifles. A month ago her nose was cleared of mucous polypi by Dr. Leland, but they have now returned. Her appetite has been ravenous and her thirst excessive.

"The patient is a rather heavily-built woman about five feet five inches tall and weighing one hundred and seventy-five pounds. She stands fairly erect, without the marked kyphosis which has been noticed in many of these cases. Her face appears somewhat lengthened, and the frontal aspect of the head is triangular in shape from an enlargement of the jaws, especially the lower, the under teeth closing a little outside the upper. There is no elevation of the eyebrows, but the eyelids appear puffy, and the skin of the face is thickened and masklike. The nose is noticeably large, the enlargement being in both the soft parts and the bones. The hair of the head, as well as of the pubes and axillæ, is coarse and dry, but very abundant and only slightly streaked with gray. The teeth are in good condition, but there is some retraction of the gums. The tongue is enlarged to at least a half more than its normal size. Over considerable areas on the neck and face the skin, which is everywhere moist, is brown in colour, and similar patches of discoloration are seen over the trunk and limbs. Scattered over the neck and trunk are very numerous small growths varying in size from the head of a pin to that of a bean, some of which are deeply pigmented. A few are pedunculated but most are sessile. There is no marked fulness above the clavicles. The clavicles themselves are not noticeably enlarged, but the manubrium seems heavier and thicker than normal, while the angle at its juncture with the second piece of the sternum is more than usually acute. Over the manubrium the percussion note is somewhat dull, the probable result of the increased thickness of the bone.

"The ribs seem heavier and are somewhat closer to each other than they should be. Owing to the thick fat layer, it is difficult to determine changes in the ilia, but they seem to have become thicker and heavier. There is a very marked enlargement of the hands, especially in their breadth and thickness, which is due less to changes in the bones than in the soft part covering them. The fingers are thick and stubby; the nails are short, broad, and marked with longitudinal striations. The crescent is covered.

"The feet show similar alterations, but in them an enlargement of the bones is more readily made out, the toes appearing decidedly longer than normal. The ankles and lower part of the legs are puffy and pit deeply on pressure. The chest is fairly well shaped and measures at the two respiratory extremes 32 and 34½ inches. Except for a prolongation of the expiratory sound, which can be accounted for by a loss of elasticity of the chest walls, examination of the lungs is negative. The area of cardiac dulness is slightly enlarged laterally, but, except for their rapidity and weakness, there is no modification of the sounds.

"The voice is thick, monotonous, and plaintive, while words are very slowly enunciated. All muscular movements are slow and weak, while the tenderness of the hands is so great that she is unable to grasp the dynamometer with sufficient force to move the index. Pulse 128. Temperature 100° F.

"The following measurements of the head, hands, and feet may be of interest. The patient is left-handed.

Circumference of head	21⅞	inches.
Circumference (chin to vortex)	26	"
Circumference of right palm	8¼	"
Circumference of left palm	8⅜	"
Length of right middle finger	4	"
Length of left middle finger	3⅞	"
Circumference of middle finger (proximal joint)	3	"
Length of right foot	9¾	"
Length of left foot	9⅞	"
Width at ball	3⅜	"
Length of great toe	2¾	"

The enlargement of the hands and feet, however, is more conclusively shown by the larger sizes of gloves and shoes which she now requires than by these measurements.

"For the examination of the special senses as well as for the electrical tests I am indebted to Dr. P. C. Knapp, who went over the case with much care. Smell is nearly lost, there being no perception of camphor or menthol with the right nostril and only slight with the left, a condition probably explained by the presence of polypi. Vision is practically normal, the field is not contracted, and the colour sense is good. Nothing abnormal was seen in the fundus oculi. Hearing in the right ear is normal, but with the left ear a watch can not be heard more than six inches away. Taste, cutaneous sensibility, and the muscle sense are unimpaired.

"The electrical reactions are considerably diminished quantitatively to galvanism and slightly to faradism, but there are no qualitative changes. The urine had a specific gravity of 1·018, and contained neither sugar nor albumin; the daily amount was slightly in excess of the normal quantity.

"She was put on general tonics and on the dried extract of thyreoid gland in gradually increasing doses until 12 grains a day were taken, while galvanism was for a time given by Dr. Knapp. On the 17th of April, three months after her first visit, she reported that she was feeling very much better and took more interest in current events. Her memory had improved, and she spoke and moved more rapidly. Pain in the hands had greatly diminished, so that she slept well at night, but her joints still felt stiff. Her grasp was firm, and she was able to do her own washing and ironing, even to wringing out the clothes with her hands. The 'puffing' in her ears was gone, and the palpitation of the heart better. There was much less puffiness about the eyes and no pitting over the ankles. She had lost over

twenty pounds in weight, but felt stronger than for many months.

"From this time to the present her general condition has remained practically the same or possibly has slightly improved. She has been able to do all her own housework, even to the sewing, and has also gone out on one or two occasions in the capacity of monthly nurse. Her mental condition is normal, except that she complains that her memory is still somewhat defective. Her weight is still further reduced so that she now tips the scales at one hundred and forty-six pounds, but there has been no change in the measurements of her hands or feet. The longitudinal furrows on her nails are, however, less marked, and her tongue shows a considerable diminution in size. The mucous growths in the nose have disappeared, and the nasal passages are unobstructed. During last June she suffered for a time from very severe vertical headaches, and she has had occasional attacks of palpitation and vomiting, which were apparently due to an overdose of thyreoid extract, which she has taken almost continuously in daily amounts varying from 3 to 9 grains. The temperature, which was taken only at infrequent intervals, ranged from 98·5° to 99·2°, more commonly the latter.

"The history of the case and the marked physical changes leave little doubt that we were dealing with a case of acromegaly, but certain anomalous symptoms—such as the puffy conditions of the eyelids, which may, however, have been simply the result of anæmia, though its appearance was somewhat different, the slow speech, and the altered mental state—suggested that her condition was also associated with a loss of function of the thyreoid gland, which was strengthened by the fact that it could not be felt even after she had lost considerable flesh, and the decided improvement following the administration of thyreoid extract. The direct effects of treatment were seemingly apparent in the loss of weight, the diminished trophic disturbance of the nails, the decreased size of the tongue, the disappearance of the mucous growths in the nose, and perhaps also, if Schaefer's observation is correct, that the thyreoid secretion dilates the blood-vessels, in the cessation of pain in the hands: but in the latter case it is somewhat doubtful how far this result was due to the action of the remedy, and how far to the diminishing influence of the climacteric which she had recently passed, and which may have been a more or less potent factor in causing pain from the vaso-motor disturbances incidental to it. The other treatment employed consisted of tonics and the careful regulation, so far as possible, of her diet and general hygiene.

"Regarding the ætiology of the case, the condition of her brother, as she describes it, is interesting as showing a possible family taint, which has not been observed in any of the reported instances; but the facts are too meagre on which to base even a probable diagnosis, and as he lives many miles away no more definite information could be obtained. In her own history no adequate cause could be found. It is true that she dates her symptoms from the time when she was struck with a flat-iron, but the nervous shock which this produced simply called her attention to a condition which had imperceptibly come on, as a photograph taken some months, at least, before the accident shows that quite marked changes had already taken place."]

A considerable reduction in the size of the thyreoid gland in *goître* has been repeatedly obtained by the use of thyreoid extract, and a few cures have been reported. Bruns is quoted by Murray as having treated twelve cases of parenchymatous goître in young persons with raw thyreoids, with the result that four were cured, five were improved and the goîtres lessened in size, while three were not improved. This ratio of cures appears to be unusually good, and the thyreoid treatment has certainly been proved worthy of trial in cases of this nature.

[Professor Kocher, of Bern, says the *Lancet* for July 20, 1895, has communicated to the *Correspondenzblatt für schweizer Aerzte* his experience of the treatment of goître by means of thyreoid administration. The effect is unmistakable, he says, the swellings becoming distinctly smaller. Symptoms of suffocation may be abolished by the treatment in consequence of the diminution in size of the goître, but in no case did the swelling entirely disappear. Only in three cases was the treatment unsuccessful, and one of these was that of a large cystic goître in which success could scarcely be looked for; but, in spite of this success, Professor Kocher utters a warning against too sanguine views as to the success of thyreoid treatment of goître, and expresses the opinion that this mode of treatment is not more efficacious than that by iodine. Success, he says, is to be expected only if the treatment is undertaken at the right time and is carried out with energy and patience.]

In exophthalmic goître the weight of opinion inclines to the view that thyreoid extract is contra-indicated. Attention has already been called to the fact that excessive doses of the extract, given in myxœdema, create symptoms which closely resemble those of exophthalmic goître, and it may also be noted that the view at present generally accepted regarding the pathological condition of the thyreoid gland in this disease is that it is "a true hypertrophy of the glandular elements of the gland with increase of its secretions and possibly some change in the character of that secretion" (Starr). If exophthalmic goître is a disease dependent upon overactivity of the thyreoid gland, as our present knowledge seems to indicate, the administration of thyreoid extract will not be followed by improvement, but rather by an exaggeration of the symptoms. The reports of results obtained by the use of the extract indicate not only that it is of no service, but that it is frequently injurious. Only once has great improvement been reported, and there is good reason to believe that another tissue was substituted for the thyreoid gland in this case and that thyreoid extract was not given. Thus theory and ex-

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perience unite to discountenance its employment in this disease.

[Dr. Ferdinand Winkler (*Centralblatt für die gesammte Therapie*, vii, 1895; *American Journal of the Medical Sciences*, October, 1895) states that Menzies has seen great benefit from the thyreoid treatment in six cases of *syphilitic rupia*, and Abraham a marked improvement in two patients suffering from *leprosy*.

Jouin (*Mercredi médical*, July 31, 1895; *New York Medical Journal*, August 31, 1895) has employed thyreoid extract for patients suffering with *fibrous tumours of the uterus*. He gave from four to eight tablets a day, each containing 2½ grains of the extract. In three cases he observed a diminution of the hæmorrhage, and in two cases the partial disappearance of the tumour. He thinks that researches should be pursued in regard to this method of treatment, although our present knowledge of the physiology of the thyreoid gland enables us to give only very hypothetical explanations in regard to the action of the thyreoid juice in the treatment of fibrous tumours.

Tetany is an occasional result of removal of the thyreoid gland, and it seems susceptible of cure in some cases by means of thyreoid treatment even when the gland is present and apparently healthy. Thus, Dr. Levi-Dorn (*Therapeutische Monatshefte*, February, 1896; *Therapeutic Gazette*, April, 1896) relates the case of a tailoress, twenty-one years old, who, three years before she came under his observation, had sought to relieve herself of sweating fingers by cold hand baths. She had afterwards at times spasms in both hands—the fingers would become so tightly clenched that they could not be loosened by the free hand; after a few days the hands would recover their natural flexibility. On July 7, 1894, the spasms occurred in connection with the premature birth of a boy. The spasms had the old form, continuing only a few days, always limited to the upper extremities. Then there set in frequently a feeling of itching in all the limbs. The patient experienced great weariness, drowsiness, increasing heat, and anxiety. The weariness was greatest on rising in the morning. A tendency to profuse perspiration was of long standing. The disturbances increased. The patient's father had worked for twenty-five years in metals, especially lead and mercury, but showed no sign of poisoning. The mother herself had died of tuberculosis of the lungs. Five brothers and sisters had died at an early age, from scrofula or weakness, or both (four of them were twins). The patient herself presented all the symptoms which belong to tetany. Pressure upon the internal bicipital sulcus caused paræsthesia in the affected arm, followed by the typical position. The fingers were held in position for holding a pen, or clasped into a fist with the thumbs turned in. The mechanical excitability of the nerves was much increased. The disease seemed to have been started by the chilling of the hands and to have been aggravated by the premature labour. No association with any infectious disease or poisoning or stomach disease could be established, and no disease of the thyreoid could be discovered. Tablets of thyreoidin were now given, one tablet daily, and rapid improvement followed after three days. The spasm ceased after the sixth dose, to return temporarily fourteen days later, after menstruation. Apart from this, the patient remained completely cured of her tetany. Her general condition was decidedly improved, so that she could work again. Altogether, not more than seventeen tablets were taken. Each tablet contained ⅔ of a grain of thyreoidin. Her health had persisted up to the time of the report, a period of four months and a half, without medication.

M. Lépine (cited by Meige, *Revue internationale de médecine et de chirurgie*, August 10, 1896) has employed the thyreoid treatment in two cases of *myopathy* and obtained successful results. To one patient, forty-four years old, who had suffered for eight years with the disease, 2 oz. daily, on an average, were administered every week for a period of two months. The fresh gland was mixed with powdered marsh mallow. Amelioration took place in about two weeks after the beginning of the treatment. The patient felt stronger and was able to walk alone, which he had not been able to do for some time. In the second case M. Lépine ascertained that if the thyreoid treatment did not improve the atrophy, it, on the other hand, considerably ameliorated the condition of the muscles, which had been affected for some time.

In the *American Journal of Insanity* for July, 1896, Dr. Joseph G. Rogers, of the Northern Indiana Hospital for the Insane, gives an account of two cases of *catalepsy* of long duration in which prompt beneficial effects followed thyreoid medication after the complete failure of other methods of treatment. The principal points in the more remarkable case, he says, are as follows: In the autumn of 1890, during or after an attack of malarial fever, the patient evinced mental aberration for about two weeks, with hallucinations and delusions of impending personal harm and legal involvement. Subsequently he was apparently well until the middle of January, 1892, when he was attacked by *la grippe*, speedily complicated by maniacal symptoms; he was noisy, restless, and sleepless; he had delusions of dread, which were occasionally violent (he once fired a pistol at an imaginary enemy); he was very hilarious at times, laughing and singing without provocation, and then melancholy and dreamy. He was admitted into the hospital two weeks later, on February 2, 1892, in a fair physical condition, and showed no salient symptoms of mental alienation in conversation or conduct, but his letters to relatives, shortly after, indicated delusions of conspiracy and revenge. He soon became accustomed to his surroundings, took part in the ward work and amusements, attended chapel and the dances, and was agreeable, cheerful, contented, well-behaved, and gentlemanly. On June 9, 1892, he was sent home, apparently in a fair mental condition, but not discharged. On October 14, 1892, he

was returned to the hospital in a state of great mental depression, which had existed for some time previously. For some weeks following, at times, he would lie for hours in a trance, neither speaking, moving, nor giving attention to ordinary external impressions, and, if forcibly aroused, would at once become violent and strike those about him. Between the paroxysms he was melancholy and silent, but would take some exercise and a sufficiency of food. The trance state, however, recurred more and more frequently, and on Christmas day, 1892, it became continuous, and nasal feeding was begun, because food placed in the mouth would remain unswallowed. Meantime, however, he had been fairly well nourished. For three years continuously but little change in the case was manifested. He lay during all this period like a log, to all appearances wholly oblivious to external impressions or internal sensations, uttering no sound and making no sign indicative of mental action, unless it was an occasional secretion of tears which was often noticed. For many months the limbs could be readily placed in any position without positive resistance and would remain so placed for some time, however grotesque the attitude; later they became less flexible and assumed a fixed position, which could not be changed without the use of great force, which was avoided. Sensibility to touch and pain seemed to be almost annulled; the faradaic current produced muscular contraction, but was not notably noticed by the patient. This condition continued without material change until November 1, 1895. During the first months of observation tonics of various sorts, together with faradaic electricity, massage, and baths, were diligently used, but they were of no avail, and all treatment other than good feeding, frequent bathing, and careful attention to warmth of body was finally stopped. He suffered no intercurrent ailment; assimilation and excretion were sufficient and regular; there seemed to be no hopeful indication for any particular method of treatment, and none was attempted for many months, until the author determined to test the efficacy of thyreoids, and on November 1, 1895, the treatment was begun. On the 6th active movements of the fingers were noted, on the 24th the lips moved slightly, and on the 29th the patient extended his left arm almost straight. The average temperature increased a degree or more and became normal, while the pulse rose to 90. The treatment was suspended until December 16th, when it was resumed and continued until January 23d, at which time it was stopped on account of the rapid action of the heart. During this period of forty-one days of medication the temperature and respiration became normal and for a few days were somewhat above it; the pulse remained at about 80 for two weeks, and gradually increased until it reached 140; it was soft, small, and regular. On the 17th of January the patient was placed in a sitting posture and was able to take a cup of eggnog and drink it. On the 27th the temperature was 101° F. and the pulse 150; he laughed audibly and was quite restless. An attendant offered him a piece of paper and a pencil, and much to his surprise the patient took it and wrote that he would like to have his mouth washed out with a soft cloth, and that he would like a little cold water to drink. In the course of the evening he wrote several sentences. This condition lasted until February, when a complete relapse took place. On the 7th his condition was unchanged, on the 17th he was able to take soft food, and on the 23d he was able to speak. On the 29th he sat up during the day and ate well. During the month of March no thyreoids were given; the pulse went down gradually and it required two weeks to reach its normal state; the respiration and temperature became slightly subnormal. The relapse toward inactivity, says Dr. Rogers, when the remedy was stopped was not so complete as before, but still very notable. For a time mastication was difficult. On March 9th the patient got up and walked with some assistance to another room. On the 12th massage was begun, and on the 28th the use of the thyreoids was again resumed. On April 7th there was a slight improvement, which gradually increased until May 27th. On that date the patient wrote a letter to his mother and was able to walk from one building to another. From that time up to that of Dr. Rogers's writing he was mentally almost normal, and, although physically weak from long inactivity, he took short drives and walks, and showed general evidence of having reached permanently a plane from which he might be reasonably expected to pass on to a condition of health.

The important deductions to be made from the histories of these cases, says Dr. Rogers, are the following: 1. That in conditions marked by inhibition of sensory, motor, and mental activity, without gross organic lesion, such as are met with in *catatonia* and in certain types of *stuporous insanity* and *melancholia*, we may expect benefit from thyreoid medication, judiciously used. 2. That the effects of thyreoids in full doses bear a striking resemblance to many of the symptoms of Graves's disease—namely, orbicular weakness, consecutive conjunctivitis, skin eruptions, and temporary bronzing, without icterus of the eyes, profuse local fœtid sweats, subjective sense of heat and thirst, excessive metabolism, decided tachycardia, and the absence of any fixed relation between pulse-rate, respiration, and temperature. 3. That the theory of Möbius, that Graves's disease is due to overactivity of the thyreoid gland, is strongly supported.

Thyreoid feeding has been employed for the novel purpose of checking the growth of the fœtus *in utero*, so as to admit of the birth of a viable child in cases of *deformity of the pelvis*. At a meeting of the Vienna Geburtshilflich-gynäkologische Gesellschaft held on March 3, 1896 (*Centralblatt für Gynäkologie*, July 4, 1896; *New York Medical Journal*, August 1, 1896), one of the members related the case of a woman whom he had attended in labour the year before. She had an infundibuliform pelvis on which the spines of the ischia encroached decidedly, and there was an

exostosis on the right ilio-pubic tubercle. The fœtus was very large, weighing over nine pounds. After repeated attempts at extraction by the high forceps operation, the reporter had had to resort to craniotomy, and even after that had been performed the extraction of the child had been very difficult owing to its size. The woman had since come under his care in the fourth month of pregnancy. In pursuance of Prochownik's idea of restricting the growth of the fœtus by dieting, he had, from the beginning of the fifth month, employed thyreoid feeding, giving one tablet a day. At first the woman had increased in weight, but in the later period of the treatment a loss of weight was observed each week. It was judged that the growth of the fœtus was well under control, and the pregnancy was allowed to go to term. When labour came on, the head was driven into the pelvic cavity, but its further advance was impeded by the projecting spines of the ischia. On that account the forceps had to be applied, the head having rotated normally, and a living child weighing about six pounds and a quarter was easily extracted. The reporter admitted that it was very questionable whether this difference in the weight of the two children was due to the thyreoidin treatment alone. The treatment had been begun in two other cases of pelvic contraction that had since come under observation at a sufficiently early stage of gestation, and from the results in those cases some opinion might be formed as to whether the dwarfing of the fœtus in the case related had been *post hoc* or *propter hoc*.

Curiously enough, thyreoid treatment, which, as we have just seen, has been resorted to for the purpose of checking the growth of the fœtus, has been employed also to overcome *stunting of the growth*. But this is to some extent explained by Dr. J. J. Schmidt (*Therapeutische Wochenschrift*, November 15, 1896; *New York Medical Journal*, December 12, 1896). After referring to Virchow's observation, in 1883, on the relationship of rickets, cretinism, and dwarfing without any disease of the thyreoid gland being recognised as at the bottom of the relationship, he goes on to say that the thyreoid probably plays an important part in simple stunting of the growth, as well as in cretinism and infantile myxœdema. He cites a number of recorded examples of dwarfing associated with atrophy of the thyreoid gland, and adds that experiments on animals corroborate the idea of a direct connection between the two conditions, as well as that of the feasibility of effecting by thyreoid feeding the restoration of normal growth checked by thyreoidectomy. Among the interesting observations cited is one by Lanz of a hen which, four months after having had her thyreoid gland removed, laid an egg that weighed only about a tenth of what an average hen's egg weighs and had a shell as thin as paper. Dr. Schmidt gives brief notes of four cases in which he has resorted to thyreoid treatment to overcome dwarfing in children. The first was that of a girl, thirteen years old, but of the size of a girl of ten, whose growth was restored by thyreoid feeding for a period of eighteen months, followed by a five months' course of a daily tablet of Baumann's thyreoiodinin. The second was that of a girl, fifteen years old, in size only a child of eleven, who, as the result of ten months' treatment with thyreoiodinin, had gained in weight about ten pounds. The third was that of a boy, sixteen years old, but no larger than an ordinary boy six years of age, who after a six months' course of treatment with English thyreoid tablets had grown more than two inches in stature and gained over ten pounds in weight. The fourth was that of a seven-year-old girl so small that her four-year-old brother exceeded her in height. After she had taken a Baumann's thyreoiodinin tablet daily for four months it had been found that she had grown two thirds of an inch taller and was more than two pounds heavier. This was not quite satisfactory to Dr. Schmidt, and he ordered two of Engelhardt's thyreoid-gland tablets to be taken daily. Not enough time had elapsed since his making this change to enable him to report on the result.]

MATTHIAS LANCKTON FOSTER.

THYREOIDIN.—This substance, which must not be confounded with *thyreoiodinin* (*thyreoiodine*), is a powdered extract of the thyreoid gland of the sheep or the ox. It may be given in daily amounts of from 5 to 10 grains. For its uses in therapeutics, see THYREOID TREATMENT.

THYREOIODINE, THYREOIODININ.—The latter of these two names is to be preferred as being a closer equivalent than the other of the German name *Thyreojodin* given to the substance by its discoverer. In addition the name *iodothyrein* has recently been given to it. It is an organic iodine compound found by Baumann to be a normal constituent of the thyreoid gland and thought to be its active principle. It is an amorphous brown powder readily soluble in alcohol, but almost insoluble in water. According to Professor Ewald, of Berlin (*Wiener medizinische Blätter*, June 4, 1896), the fresh gland contains from 0·2 to 0·5 per cent. of thyreoiodinin, about one tenth of which is iodine. The therapeutical action of thyreoiodinin is in most respects practically identical with that of the thyreoid gland itself, but it is thought to be exerted more speedily.

Baumann (*Münchener medicinische Wochenschrift*, April 7, 1896; *Centralblatt für innere Medicin*, September 19, 1896) describes thyreoiodinin as containing nitrogen and iodine in very stable combination and as being almost insoluble in cold water and in ether, and as having a remarkable resemblance in some respects to an iodine compound recently prepared by Drechsel from corals. Only a small amount of free thyreoiodinin is contained in the thyreoid gland, most of it being combined with albumin and globulin, but by repeated extraction with diluted chloride-of-sodium solution all the iodine compounds may be removed from well-minced glands. Since an effect is often seen earlier from thyreoiodinin than from the fresh gland, Baumann assumes that thyreoiodinin is the active principle of the gland.

A curious thing mentioned by Baumann is the fact that numerous observations show that in Hamburg and Berlin the thyreoid gland contains much more iodine than in Freiburg, as a rule, and that this is particularly the case with children, in whom the amount is relatively small. The quantity of iodine contained in the gland seems to be but little influenced by disease, he says, but to be notably increased if iodine in any form is absorbed. Since only a very small amount of iodine is found in goîtres, and since the amount found in the gland in goîtrous regions is small, says Baumann, the old doctrine of the influence of the quantity of iodine present in a locality—in the food, in the air, and in the water—on the development of goître receives fresh support. Iodine is an element necessary to life, and if no marine fish are consumed, it must enter the system chiefly in the vegetable food.

Baumann has recently succeeded in finding iodine in the thymus of the calf, and he thinks it probable that in that organ also it exists in the form of thyreoiodinin. In most instances, when the amount of thyreoiodinin contained in the thyreoid gland has once been increased by the ingestion of iodine into the system it remains abnormally large for a long time. Ordinarily, therefore, a good deal of thyreoiodinin is found in the thyreoids of persons who have taken iodine for a time. This is true even of goîtrous individuals, although usually the amount of iodine contained in a goître is smaller than that contained in the healthy gland.

There is some reason to think that thyreoiodinin is not in every way the medicinal equivalent of the thyreoid gland. Dr. J. A. Notkin (*Wiener medizinische Blätter*, October 22, 1896; *New York Medical Journal*, November 14, 1896) thinks that the phenomena caused by extirpation of the thyreoid gland are divisible into two classes, one being the symptoms of tetany and the other those of myxœdema. He thinks it probable that the phenomena of myxœdema occur only when there is left some remnant of the thyreoid parenchyma capable of performing its functions, also that myxœdema is caused by an albuminous principle, thyreoproteid, whereas tetany depends on poisoning with products of metabolism which are not of an albuminous nature. Baumann's thyreoiodinin, he says, will cure goître and myxœdema, but it has been difficult to assume *a priori* that it would also cure tetany. It appears from data furnished by Fränkel, Kocher, Jr., and Gottlieb that besides thyreoiodinin the thyreoid gland contains other specifically active substances.

Notkin undertook an experimental investigation as to the truth of Baumann's contention that thyreoiodinin would cure all the results of removal of the thyreoid gland. In the first experiment the entire gland was removed from a dog. Two days later there were fibrillar and occasionally clonic contractions of the muscles of the limbs. On that day and on the following day 45 and 60 grains of thyreoiodinin respectively were given to the animal; nevertheless, the most pronounced cachexia strumipriva was developed. The dog was now almost dead, when, by the means of a stomach-tube, 45 grains of Merck's preparation of dried thyreoids were introduced into its stomach. In the evening the convulsions ceased, and on the following day 45 grains more of the Merck preparation were given. On this day and the next the dog was lively and free from convulsions. Now in the course of two days 180 grains of thyreoiodinin were given to it, and again fibrillar contractions showed themselves, and there was an attack of tonic and clonic convulsions.

In the second experiment thyreoiodinin also proved incapable of causing the subsidence of the tetanic symptoms; indeed, they became more intense under its employment, and even when injected subcutaneously it failed to affect them.

In the third experiment the animal was treated with thyreoiodinin beforehand. In spite of this and of the large doses employed after the onset of the convulsions, the dog could not be saved from the severest symptoms of the cachexia. The urine of all the three dogs was albuminous.

From these experiments Notkin concludes that thyreoiodinin is incapable of overcoming the phenomena of tetany; however, he did not use Baumann's own preparation, and this, he says, may account for the difference between his and Baumann's results.

With regard to the action of thyreoid-gland preparations, says Ewald (*loc. cit.*), we have to distinguish between two constituents; one of them gives rise to objectively recognisable changes of metabolism, and the other is related to certain subjective symptoms which range from slight discomfort to pronounced morbid phenomena, constituting *thyreoidism*. Under certain circumstances metabolism may be notably heightened by thyreoid preparations, and this heightening can not fail to effect the general condition, as is shown by debility, loss of appetite, nausea, thirst, sleeplessness, depression, dizziness, pains in the back and in the loins, increased frequency of the pulse, palpitation of the heart, sensations of oppression, and stenocardiac attacks. These phenomena are more or less pronounced in all cases of sudden alteration of metabolism which are connected with a rapid breaking up of a substance containing albumin and with a heightened combustion of fat.

The employment of thyreoiodinin, even to the amount of a drachm in twenty-four hours, says Ewald, has no material influence on the pulse, and there can be no chance of iodine poisoning, because the amount of iodine contained in the thyreoid gland and its preparations is very small (one part of the sheep's thyreoid contains 0·0003 of one part of iodine); such consequences, however, as increased frequency of respiration, headache, pains in the limbs, salivation, urticaria, palpitation, and tremor have been reported. Often enough, on the other hand, there is no reaction, in spite of the employment of large amounts of preparations known to be active. Besides the toxic symptoms mentioned, albumin, casts, and

sugar are occasionally found in the urine as a result of thyreoid treatment. In the majority of the cases of glycosuria the excretion of sugar is only temporary, but in one observed by Ewald, that of a woman, after having first occurred off and on, it settled down into a continuous diabetes from which the patient was still, four years after its first appearance, suffering, or rather not suffering, for beyond the glycosuria she had no subjective or objective symptoms of diabetes. In the many cases in which of late years Ewald has employed thyreoid-gland preparations he has almost invariably examined the urine for sugar, but has never found glucose, even in corpulent patients. He has therefore been surprised to learn that Noorden has observed glycosuria five times in seventeen cases of thyreoid feeding in the corpulent, although it quickly disappeared on discontinuing the treatment. It will be interesting to observe, he says, whether this phenomenon takes place also in the thyreoiodinin treatment, with the avoidance of all sugar in the preparation; we shall then know whether its occurrence is due to the specific action inherent in the gland or is a toxic by-effect.

The secretion of the thyreoid gland, says Ewald, is continuously being carried into the circulation in minute amounts, where its office is to destroy certain poisonous substances of unknown nature whose existence is inferred from the toxic phenomena which follow loss of the gland or of its function—athyreosis or ecthyreosis. That these phenomena are not merely accidental rests as well on their nature, which is always in part that of active irritation, as on the results of replacing the defective secretion or of artificial increase of it—hyperthyreoidism. Moreover, he adds, the secretion acts as an antidote to certain toxines which appear as by-products of metabolism. If the secretion is insufficient, these toxines accumulate and metabolism is reduced; if it is secreted or introduced into the system in excess, so that the point of neutralization is overstepped, and there is too much thyreoiodinin in the organism, the specific effects of this substance will show themselves. That the gland bears an essential part in metabolism, he remarks, is evident from the facts that as soon as an excessive amount of thyreoiodinin gains access to the circulation an acceleration of metabolism occurs, even to the point of a morbid increase, and that, conversely, its reduction is the result of failure or deficiency of the glandular secretion. The difference between the normal and the pathological state is one of degree only, he thinks, and in this matter the behaviour of the thyreoid is in no wise different from that of other glands.

In regard to the dose of thyreoiodinin, says Ewald, the rule has been promulgated to begin with minute doses, to increase them gradually, and not to make them too large at any time. It has been shown that the employment of very large quantities—the equivalent of one or two glands—has no therapeutic advantage, but sometimes does harm by causing a sudden outbreak of thyreoidism. The daily maximum allowable, according to Ewald, may be regarded as ten tablets, corresponding to 0·045 of a grain of iodine.

Unquestionably, says Ewald, the prime indication for the use of thyreoiodinin is found in *myxœdema*, but it is almost as much indicated in *sporadic*, or *infantile, cretinism*. The idea of using the thyreoid preparations in skin diseases, says Ewald, was founded on observations of the myxœdematous, in whom a striking improvement of the state of the skin and of the general nutrition had been seen to follow their employment. The treatment is especially useful in *psoriasis vulgaris*, in *lupus*, in *ichthyosis*, in *xerodermia*, and in *sclerodermia*. It seems to Ewald that the dermatologists, at least in Germany, are still rather cold toward this treatment, but he admits that the greatest reserve is justifiable, especially with regard to psoriasis, in which spontaneous and utterly unexpected recoveries are not infrequent. It is different with the treatment of *corpulence*, he says, which must make an impression on the observer who records the great loss of weight by the myxœdematous. A loss of weight to the extent of ten kilogrammes in six weeks—on the average, of from four to five kilogrammes—by the daily use of from three to five tablets takes place, but it is only in exceptional cases that the reduction of flesh proves lasting.

Since it may be considered certain, says Ewald, that metabolism as a whole, including the destruction of albumin and the combustion of fat, is increased by the thyreoid treatment, independently of any special change of diet, the loss of albumin might be reduced to a very small one by increasing the ingestion of albumin, and so an ideal treatment of obesity be made use of—one that would reduce the fat without detriment to the albuminous constituents of the body.

Two questions, however, Ewald thinks, are still to be met: 1. Why is it that many corpulent persons are completely refractory to thyreoiodinin? 2. Has thyreoantitoxine or thyreoiodinin the same action as the entire gland? As regards their behaviour under thyreoid treatment, he says, obese persons can not be grouped into those who have grown corpulent in consequence of improper diet and those who have become fat in spite of a strict regimen: in each of these groups there are those on whom this treatment acts favourably and those on whom it acts unfavourably. There are certain conditions under which the system clings pertinaciously to its fatty elements. This is most forcibly shown in pernicious anæmia. The striking obesity of persons who die of this disease shows how obstinately the organism may preserve its fat in spite of the ingestion of nutritious material being reduced to the utmost, and, as recent investigations have surely shown, in spite of the fact that the assumption of oxygen and the loss of carbon dioxide are not reduced. The second question Ewald answers in the affirmative, and cites instances of a rapid and decided reduction of obesity as the result of treatment with thyreoiodinin.

Dr. Grawitz (*Münchener medicinische Wochenschrift*, 1896, No. 14; *Deutsche Medizinal-*

Zeitung, June 15, 1896) relates the cases of two women who were treated with thyreoiodinin for obesity. In one of them the use of the remedy was continued for only three days, at the rate of 15 grains a day. During this period the patient lost three kilogrammes in weight, and this, says Grawitz, was all the more remarkable from the fact that she took milk, butter, white bread, and eggs freely, although restriction in the matter of these articles before the thyreoiodinin was used had brought about only a very trifling loss of weight. An increased excretion of nitrogenous matter was evident in this case—to the amount of about an ounce—so that a decided loss of weight could not fail to result. There was however, no increase of the fluid excretions, and the urine contained neither albumin nor sugar. The other patient took 15 grains of thyreoiodinin daily for three weeks, without any restriction of her diet, and she, too, lost three kilogrammes in weight. When she discontinued the use of the remedy her reduction of weight persisted for a short time, but she soon began to regain her flesh. Her subjective condition was not affected, and her urine was free from both albumin and sugar. Cf. THYREOID TREATMENT.

THYREOPROTEIN.—This is a poisonous albuminoid isolated by Notkin from the thyreoid gland. It is thought to be a substance which it is one of the functions of the gland to eliminate from the organism.

TIGLIUM.—See CROTON OIL.

TIN appears to be physiologically inert and is without medical uses save in the granulated or powdered form, which has been employed for the expulsion of tapeworms. It is assumed to act mechanically. It may be given in drachm doses every morning until the worm is expelled. It is an unnecessarily harsh remedy, and not without danger, so it is rapidly passing out of use. The only salt of tin which is of interest is the chloride, which is occasionally found in carelessly put up canned goods, being formed by the action of the hydrochloric acid, employed as a flux in the soldering upon the tin. It has been stated that enormous doses are without physiological effect, but it is probably more or less corrosive. In cases of poisoning caused by the eating of canned food the effects produced are rarely if ever due to this salt, but rather to the ptomaines derived from the decomposed food and to the lead in the solder. The symptoms observed are those of gastro-enteritis, and they occur usually after the eating of canned fruits and vegetables which are naturally acid or become so in the cans. As tin is but little affected by the vegetable acids, the lead is probably the most important metallic element in the cases.

Many cases of lead poisoning have occurred in which the so-called "tin foil" (in reality one or more thin sheets of lead covered with tin) has been the cause. Little of the tin foil in the market is free from lead, and its use in pharmacy and to envelop foods should be discouraged.—RUSSELL H. NEVINS.

TINCTURES.—These are liquid preparations, consisting mostly of solutions in alcohol, alcohol and water, or a similar solvent, of the soluble constituents of crude drugs which are not entirely soluble in the menstruum. For convenience' sake, a few preparations not exactly fitting this definition are usually classed as tinctures—for instance, *tincture of iodine*, although the iodine is completely soluble in the menstruum.

Tinctures may be prepared either by maceration (or solution) or by percolation. Maceration is usually resorted to when the drug to be extracted is of such a nature that it would cake together if packed in a percolator and prevent the solvent from penetrating it. This is the case particularly with resins, gum resins, and drugs containing a large proportion of soluble matters. These are always best extracted by maceration. But maceration is adapted also in all other cases without exception, and is in some countries still the only process recognised officially. It is, however, rather slow and tedious, and for this reason is now getting to be more and more replaced by the process of percolation. There is a radical difference in the principles underlying the ratio of volume or weight of product to weight of crude drug in the two processes.

Maceration, if conducted properly, is carried on in the following manner: A definite weight of a drug of known quality and properly comminuted is brought in contact with a definite volume or weight (usually the latter) of a menstruum known to be capable of dissolving the useful constituents. The mixture is set aside, well covered to prevent evaporation, but is frequently agitated or stirred so as to promote the action of the solvent. After a certain time, often extending to some weeks, when it may be judged (or may be known from previous experience) that all soluble matters have gone into solution, the contents are removed and the liquid is separated from the undissolved residue by straining. Even assuming that none of the liquid was lost by evaporation, the whole of it will in no case be recoverable, since the residue will always retain at least traces of it, even under the most powerful pressure. Hence the quantity (weight) of strained liquid obtained is likely to vary more or less each time a particular tincture is made. But this variation does not affect its strength or medicinal value. If the liquid and solid have been kept in contact for a sufficient time, with frequent agitation, the process of osmosis will have gradually brought about a uniform condition of the solution both outside and inside of the particles of the drug; and it will then be merely a matter of mechanical force to obtain not only the liquid surrounding the solid particles, but also as much of the included liquid as possible. The person who can apply the greatest force will simply have more product to sell. His product need not be supposed to be better than that of another person who was unable to squeeze as much of the liquid from the solid particle as the other. Of course, the liquid thus obtained by straining is, in most cases, turbid and requires to be filtered.

Some authorities have proposed to avoid

the discrepancy in the quantity of product, due to the variable amount of liquid retained by the drug, by treating the pressed drug with further fresh portions of the menstruum, to express again, and to add the product to the first strainings, until a definite weight or definite volume of product is obtained. But it does not need a mathematical demonstration to prove that this method introduces serious errors. It is impossible in this way to dissolve out from the interior of the particles *all* the soluble matter; even under the most favourable conditions some of it must be retained, and it would require many washings, with concomitant maceration, to attain even approximate exhaustion. If the process of maceration is to be used at all, no washing of the residue is admissible.

In the case of drugs which are quite readily extracted or almost entirely soluble it is preferable to suspend them in a cloth or other suitable material in the upper part of the column of the menstruum. As the latter dissolves out the constituents, the dense solution sinks to the bottom, causing the uncharged or lighter-charged portions of the liquid to rise and to come in contact with the drug. This is called "superior maceration."

Percolation is suitable for all substances the constituents of which are only partially soluble, and which are not apt to agglutinate in the apparatus. Such are, for instance, the drugs of a fibrous nature derived from the vegetable kingdom, but there are also others. Percolation is used to effect exhaustion of a drug by forcing through its finely comminuted particles a suitable solvent until the latter passes practically free from dissolved matters. It is therefore necessary to provide for such a condition that the liquid in its downward passage will not find an easier exit by the channels between the particles than through the body of the latter themselves. The drug must be reduced to a more or less fine powder—the finer, the stronger in alcohol the liquid is. It must be moistened with the liquid and allowed to swell as far as it will, after which it is to be packed carefully and more or less firmly—depending on the nature of the drug—into the percolator, which is a cylindrical or conical vessel provided with an outlet the flow from which may be regulated, and it is then covered by a sufficient quantity of the liquid which is to be passed through it. The percolator is now covered, and the contents are allowed to macerate, the lower orifice being open, until liquid begins to drop from the latter, which is a sign that the liquid has penetrated the mass. The outlet is then closed and the contents are allowed further to macerate for such a length of time as previous experience may have shown desirable. Then the outlet is opened and the flow of percolate so regulated that a slow but steady extraction is secured. The surface of the powder must never be without liquid, otherwise cracks and passages would form in the packed powder, which would permit of the passage of the liquid by the side of the particles.

In the case of percolation a definite volume or weight of percolate bearing some previously determined relation to the weight of the drug is the object aimed at. In most cases the ratio is so fixed that practical exhaustion of the drug is secured when the desired volume or weight of product has been obtained. Should this not be the case, and it should for some reason be desired to carry the process to complete exhaustion, while yet securing a definite quantity of product, enough liquid may be gradually passed through the drug to exhaust it actually, the solution concentrated by distillation or evaporation, and the residue added to the first percolate, the volume or weight of which may then be adjusted so as to bear the proper ratio to that of the drug.

It has often been recommended to prepare tinctures from the corresponding fluid extracts, and most manufacturers of the latter preparations furnish upon their labels directions for making the tinctures from the latter. This practice will no doubt, in a number of cases, result in the production of tinctures of full medicinal value which can not be distinguished from those specially prepared by percolation, but in many other cases the product will materially differ from that which would have been obtained by the legitimate process. When a drug contains certain useful constituents which are *alone* desirable and the *whole* of which will remain in solution in a tincture made from the corresponding fluid extract, no harm can come from this practice. But the knowledge of where this may be done without detriment is not possessed by many. It is therefore always advisable to adhere to the official directions.—CHARLES RICE.

TOBACCO, *tabacum* (U. S. Ph.), *tabaci folia* (Br. Ph.), *folia nicotianæ* (Ger. Ph.), has powerful *emetic* and *nauseant* properties, and when taken in overdoses acts as a paralyzer of the respiratory muscles and secondarily depresses the action of the heart. It resembles lobelia closely in its general effects. Its poisonous properties depend upon a crystalloid body, *nicotine*, which is obtained by distillation or extraction and is found in small quantities in the fluid which collects in old pipes. Tannin, caustic alkalies, and iodide of potassium are chemical incompatibles which may be used in poisoning with tobacco shortly after its ingestion, while strychnine is the physiological antidote. The depression, etc., observed should be combated with stimulants, ergot, digitalis, or belladonna.

Tobacco was formerly employed as a depressant nauseant in *croup* and similar conditions, but its action is so uncertain that it has been abandoned in favour of less dangerous remedies. However, in cases of emergency patients unaccustomed to its use may be made to inhale small volumes of its smoke, but it is hardly safe to allow the person himself to smoke—it is preferable to have another person do it, the former inhaling the smoke—as a number of cases of fatal poisoning have resulted from the use of a foul pipe by children.

In *impaction of fæces, intussusception, strangulated hernia,* and *painters' colic* enemata of

the smoke or of one containing not over 15 grains of tobacco often prove of great value, but if lobelia is obtainable it is much to be preferred. In *tetanus* it appears to be of decided value, relieving the muscular spasms and thus preventing in a measure the exhaustion of the patient, but great care should be observed lest its poisonous action be substituted for the condition it is intended to cure. *Poisoning by strychnine* has been successfully treated with it or its active principle, nicotine, of which $\frac{1}{10}$ of a grain is a sufficient dose, and in all conditions in which tobacco is indicated nicotine may be substituted. Being capable of hypodermic use, it may in some conditions be preferable. The employment of tobacco in poultices, etc., is inadmissible, as the rapidity of its absorption varies greatly and a lethal amount may be absorbed almost before its initial effects are observed.

In amounts smaller than those necessary to produce its marked physiological effects, tobacco, employed in the usual methods, by smoking, chewing, snuffing, or dipping (the rubbing of snuff upon the gums), may be regarded as an accessory food, as its moderate use is accompanied by a decreased demand for the ordinary articles of food without any impairment of the strength, etc. It also, during periods of great strain or deprivation from food, enables those who use it to endure what would otherwise cause a "break-down." On the other hand, when used to excess, it may cause impairment of the digestion, insomnia, palpitation of the heart, and a state resembling neurasthenia. Unfortunately, the amount which can be used without disadvantage can not be estimated, as it differs in every instance. It is pretty certain, however, that in the majority of cases it is abused and that a more moderate indulgence would be followed by slightly improved physical conditions; also the pleasure obtained from it is greater when its use is restricted to the hours of leisure and those immediately after eating. It is pretty clearly established that smoking, etc., should be discouraged among those who have not yet acquired their growth and strength, as they are undoubtedly affected unfavourably by it. Whether there are any marked pathological effects beyond these already mentioned must be doubted, as among the Oriental races, where it is used from early childhood, there are no distinctive widespread diseases. Atrophy of the optic nerve or retina has been often attributed to its abuse, but it seems clear that by itself it is without effect in that direction, but when there is a confirmed over-indulgence in alcohol and tobacco these conditions are frequently observed. As a rule, in these cases the abandonment of the habit is followed by the cessation of the atrophy.

As to what is the least objectionable method in which tobacco may be employed there will always be more or less discussion, and each user must settle the point for himself. Cigarette-smoking has been accused of being at the bottom of many evils, but beyond an irritation of the mucous membranes of the air-passages, which is due to the smoke furnished by the paper with which cigarettes are made, it is doubtful if there is anything special to be urged against their use except that they are rather more apt to induce over-indulgence on account of their availability when there would not be time to smoke a cigar.

It is a widely spread belief that cancer in the mouth and throat may be directly due to smoking, but the evidence in favour of such a theory is very slight, although there is abundant evidence that the mechanical irritation of a pipe or cigar may establish a focus for the disease in the same manner as a broken tooth may. Chewing tobacco can hardly be defended, as it is a filthy habit, causes a considerable waste of the saliva, which is probably the cause of the pyrosis so often observed in chewers, and undoubtedly increases the liability to dental caries. "Dipping" is rarely practised by any except the lowest, and is followed by irritation of the gums and destruction of the teeth.

[Dr. L. Jankau, in an article summarized in the *Medical Record* for February 8, 1896, discusses the indications and contra-indications for the use of tobacco by the sick and the convalescent. The employment of tobacco, he says, is to be forbidden in all surgical operations and in long convalescence after operations, except those practised upon the eyes, the abdomen, and the bladder. He would proscribe tobacco also in affections of the throat and pharynx, and, with certain restrictions, in nasopharyngeal catarrh. As regards internal maladies, he says one should never forget the toxic action of tobacco, and in acute and serious diseases it should never be allowed. Tobacco, he says, should be absolutely forbidden in peritonitis, typhlitis, and perityphlitis. Affections of the stomach do not form an absolute contra-indication. Subjects affected with organic disease of the heart do not ordinarily support tobacco well; at the same time, habitual smokers can use two or three light cigars a day. As to pulmonary affections, the author allows his antiseptic views to have a good deal of weight in guiding his judgment. On the score of the proved fact that tobacco smoke has an undoubted influence in suppressing the development of bacilli, he rather advises smoking for persons who are in the initial stage of tuberculosis. His reasons are the disinfecting action of tobacco upon the mouth, the depression exerted by tobacco upon the genital functions, and the favourable sedative influence of this drug upon the central nervous system. Besides that, he thinks that it tends to take away the attention of patients from themselves and make life seem more agreeable to them. Even slight hæmoptyses are not absolute contra-indications for the use of tobacco. In syphilitics he thinks that one should try to avoid only the abuse of tobacco, both as to quantity and quality. In nervous affections he would simply recommend that the amount of smoking be very carefully controlled, the number of cigars and their strength being rigorously prescribed. In cardiac neuroses particularly the greatest circumspection is to be employed. In gastric neuroses tobacco should be cut off entirely. Persons who are subject to organic affections

of the nervous system can smoke with caution.

Some years ago Dr. J. C. Mulhall, of St. Louis, published in the *St. Louis Courier of Medicine* an account of the pleasures and the penalties of cigarette-smoking. More recently, in a paper read before the American Laryngological Association and published in the *New York Medical Journal* for November 30, 1895, he returned to the subject as one speaking with a certain amount of authority, inasmuch as he had smoked cigarettes for twenty-five years. There is a reason why each one pursues a particular plan of using tobacco, says Dr. Mulhall. Early associations have much to do with the selection of the plan; but, apart from this, each method has its own particular pleasure. The man who both chews and smokes derives a different kind of satisfaction from each method, and he would derive a still different kind did he take snuff. Cigarette-smokers may be divided into those who inhale the smoke and those who do not. The latter class is a very small one and the pleasure is the same, in a milder degree, as that of the cigar-smoker and the pipe-smoker, who make a smoke chamber of the mouth. But all real devotees of the cigarette inhale. That is, with a quick inspiratory act the smoke is drawn through the larynx into the trachea and, so far as he has been able by different experiments to learn, into the first division of the bronchial tubes; not, as the public believes, into the lungs proper. Inhalation explains the pleasure of cigarette-smoking. If the cigarette-smoker did not *feel* the smoke in his larynx and windpipe, his pleasure would be gone. If an habitual inhaler of cigarette-smoke perchance smokes a brand of cigarette very much milder than that to which he has been accustomed, he will at once reject it, simply for the reason that his larynx and trachea have been accustomed to a certain degree of irritation; they have, so to speak, acquired a habit which rejects any unusual departure. For the same reason the inhaler rejects a brand of cigarettes much stronger than that to which he is accustomed, and he will not inhale the smoke of a cigar—vastly more irritating than that of any cigarette. The inhaler may change his cigarette for one more pleasing to his sense of flavour, provided always, however, that it produces his accustomed degree of laryngeal and tracheal irritation.

The pleasure in cigarette-smoking, therefore, as compared with other tobacco habits, says Dr. Mulhall, may be said to be a pleasurable irritation of the laryngeal and tracheal sensory branches of the pneumogastric nerve. He goes on to say that a person absorbs nicotine in accordance with the amount of absorbent surface in contact with the column of smoke. In ordinary smoking the mouth alone is the smoke-chamber; but when one inhales, one must add to the mouth the mucous membrane of the larynx, windpipe, and larger bronchi. There is, hence, roughly speaking, three times as much surface for the absorption of nicotine; and consequently, though a cigar contains vastly more nicotine, three fourths of it is wasted, so far as the question of nicotine intoxication is concerned, as compared with the cigarette. Moreover, the cigarette-smoker consumes two or three while the cigar-smoker consumes one. The puny cigarette is, therefore, not so weak as it appears, and with this explanation begins to appear worthy of the newspaper term "deadly." Again, the cigar-smoker, as compared with the cigarette-smoker, is an infrequent consumer. We know that, with most drugs, if we divide an ordinary dose into ten equal parts and give one part every ten minutes until the ten parts are taken, a more powerful effect is produced than if the whole were given at one dose. So it is with cigarettes. The dose of nicotine is smaller, but the doses are much more frequently repeated. Dr. Mulhall says that he himself can smoke one large, strong cigar in the ordinary manner without evidence of nicotine intoxication, but he can not smoke three cigarettes in succession and inhale the smoke without nausea or vertigo or a rapid pulse.

Dr. Mulhall says that the evil effects of cigarette-smoking may be divided into the local and constitutional. As compared with other tobacco habits, if the cigarette were composed of other ingredients than tobacco and paper, we should, as clinicians, be prepared to look for different signs and symptoms. So far as the constitutional effects are concerned, he states, as one who has carefully watched this question for fifteen years, that they are absolutely the same as those of tobacco used in any other form. The evil symptoms are always those of nicotine poisoning—not those of any other drug. The only chemist of high standing who, to his knowledge, has analyzed cigarettes is Dr. Ledaux, who presented to a section of the New York Academy of Medicine a report of the analysis of several popular brands of cigarettes. He found absolutely no evidence of any other drug but nicotine in the tobacco, and in the paper a harmless quantity of cellulose.

The attempt has been made, says Dr. Mulhall, to crush the cigarette evil by asserting that opium, cannabis indica, and other narcotics are present in cigarettes. Vice, he declares, can not be cured by misrepresentation. The only narcotic present is nicotine, and this is an evil or not according to a great many different circumstances. The chief condition in which it is always productive of great harm is youth. Dr. Mulhall says he has never seen a child (meaning one that had not reached puberty) who used tobacco habitually whose health was not in some manner badly impaired. In adolescence—and practically this may be said to be from puberty to the age of eighteen in females and to that of twenty-one in males—the evil is not so great, he thinks, but is still a great one, for, though the nervous crisis of puberty has been passed, the nervous system is still rapidly developing. The nerves are more resistant than in childhood, but, on the other hand, greater demands are correspondingly made upon them, either by the higher phases of education in one class or by the actual daily struggle for existence in the other. At several

of our great universities, says Dr. Mulhall, it has been found by exact and scientific investigation that the percentage of winners in intellectual and athletic contests is considerably higher in the total abstainers from tobacco. If it is admitted, he continues, that the use of tobacco is a great evil in the young, it follows as a self-evident proposition that any method which encourages its use must be more reprehensible than a method which discourages it, and the cigarette above all other methods presents this encouragement to the use of tobacco. In its mildness is concealed its very capacity for doing harm, for the reason that it teaches the use of tobacco. The boy at first uses only the mouth as a smoke-chamber, and as a cigarette is so mild he absorbs but a minute quantity of nicotine, insufficient to produce nausea. He gradually becomes able to consume more cigarettes, and quickly acquires nicotine tolerance. He is not allowed to pursue this method long. Invariably some other boy teaches him to inhale. At first it causes violent cough and many would never repeat the attempt, but the taunts of the other boy are heard, and with the bravado of boyhood he perseveres. The larynx and windpipe soon tolerate the smoke, then demand it, and the boy is a full-fledged cigarette fiend.

The mildness of the cigarette explains also its fast-spreading use among young women, especially the leisure-class young ladies. As a rule they do not inhale, for at the first attempt the violent cough ensuing quenches ambition in this direction, and, unlike the boy, the girl is seldom encouraged to persevere. The fear of a tobacco-tainted breath also curbs her habit. In young ladies who smoke cigarettes very moderately and who do not inhale, Dr. Mulhall has never seen evidences of nicotine poisoning. The immoderate use of cigarettes, even without inhalation, may, of course, he suggests, afford sufficient nicotine to disturb the health.

The great evil of tobacco, says Dr. Mulhall, is its constitutional effect on the nervous system. The much lesser evil is local—namely, on the upper respiratory organs. His experience is, like that of the late Sir Morell Mackenzie, that, provided there is no other factor, the use of tobacco provokes little or no disturbance of these organs. That it may aggravate a throat or nose trouble occasioned by other causes he admits, and that by its constitutional depressing effect it may aggravate such trouble; but, excluding all other causes and looking at tobacco purely in respect to its local effect, he denies that, as ordinarily used, it never causes throat disease worthy of the name. There are a few exceptions, he adds, as there are to all laws in medicine. There are idiosyncrasies in regard to the use of tobacco, with reference to both the throat and the nervous system, but they are rare; tobacco, in its ordinary use, at most produces a slight hyperæmia or insignificant catarrh in the healthy throat. As used in cigarettes—that is, by inhalation—the smoke comes in contact with the laryngeal, tracheal, and bronchial mucous membrane, and here produces in many persons the same trivial hyperæmia and secretion. This latter is pearly and is ejected with a single gentle cough. He has occasionally heard whistling râles in the bronchi of persons who inhale very deep and were immoderate smokers. Hyperæmia, not inflammation, acute or chronic, he says, is the sole disturbance. The effects in the larynx of the ordinary healthy man seem almost nil. Mario, the great tenor, inhaled cigarette smoke between the acts, and Dr. Mulhall says that he himself experiences no vocal difficulty in delivering lectures. A murderer who was confined in the St. Louis jail for two years inhaled an average of forty cigarettes a day. After his execution Dr. Mulhall examined his larynx and trachea, but could discover no evidence of morbid change other than a fracture of the hyoid bone caused by the hangman's rope.

It is because of the great value of Dr. Mulhall's communication, owing in no small degree to the fact of his being at the same time an experienced laryngologist and a confirmed cigarette-smoker, that it is here drawn upon at such length. The remark should be made, however, that not all habitual smokers of cigarettes inhale the smoke. In the discussion that followed the reading of Dr. Mulhall's paper, Dr. S. W. Langmaid, of Boston, said that, from a large experience in the treatment of prominent singers, he had found that smoking exercised a potent influence on the voice. In his own case he had learned that, in order to be in good voice, he must not smoke during the day if he was to sing that evening. Because one prominent singer could smoke and sing, this was no argument that others could do so. The best singers of to-day underwent a great deal of fatigue. He had in mind one singer with a magnificent voice in whom he felt sure he could detect the effect of cigarette-smoking. He had known another singer, an inveterate smoker, who had found it necessary to abstain as long as three weeks at a time from smoking, in order that he might be at his best for some great effort in singing. He would say that the bad effect on the pharyngeal mucous membrane was much less from cigarette-smoking than from pipe-smoking, for the reason that the smoke was not so hot. What he objected to in cigarette-smoking was its destructive effect upon consecutive thought. The cigar-smoker did not want to be narcotized; the cigarette-smoker did want this. Dr. W. K. Simpson, of New York, related his personal experience with regard to smoking and its effect upon the singing voice. At one time he had given up smoking absolutely for eight years, and passed through what seemed to be similar to the experience of the opium-smoker in his attempt to give up his habit. During this period when he was not smoking, his throat had been free from any discharge or uncomfortable sensation, and he had been able to use his voice with remarkable ease. After he had resumed smoking he had found it much more difficult to keep the singing voice in good order. A barytone did not suffer so much as a tenor from smoking. He felt that he could detect a smoker by the appearance of the throat. Dr. James E. Newcomb, of New

York, alluded to the occasional good effect of tobacco in cases of *pharyngeal mycosis* and mentioned the case of a patient of his whose decided improvement, after but little benefit from cauterization, he imputed to her having taken up the practice of smoking cigarettes, but without inhaling the smoke. Dr. Langmaid said that he had once tried the use of a solution of nicotine in a case of this kind, and with a most disastrous result. The application had been followed by immediate and severe syncope. He wished to warn against this treatment, although it had been recommended. Dr. H. L. Swain, of New Haven, said that an interesting fact brought out by certain measurements taken in the colleges relative to the physical development of the students had been that among tobacco-smokers, as a class, there was a smaller chest expansion than among other students. Dr. J. H. Lowman, of Cleveland, said that possibly the irritation observed by Dr. Langmaid in singers might have been due to many of the slight causes well known to affect the throats of singers. Some well-known singers could not expose themselves to the air while riding—was this an argument, therefore, in favour of giving up open-air exercise? Dr. Mulhall admitted the truth of Dr. Langmaid's observation as to the local effect of tobacco on the singer's throat. The tenors and sopranos, as compared with other singers, must have very perfect throats and perfect laryngeal muscular control, and hence not only the local effect but the indirect effect on the nervous system was of importance in such individuals. Ordinarily, smoking produced only a very transient hyperæmia. He had not been so successful as Dr. Langmaid in detecting a smoker by the appearance of the throat. He had never seen pharyngeal mycosis in smokers' throats, and to this extent could confirm the statements generally made on this subject by writers. A friend of his, however, had told him that he had a smoker for a patient who was affected with this disease. He could not understand how tobacco smoke could reach sufficiently deep to affect the seat of this affection. He believed he had been the first to call attention to the fact that pharyngeal mycosis was a disease which would sometimes disappear spontaneously and reappear.

The subject of *smokers' vertigo* was under discussion in 1895 before the French Congress of Learned Societies (*Progrès médical*, May 4, 1895; *New York Medical Journal*, June 8, 1895).

M. Kohos said that vertigo caused by nicotine was of very frequent occurrence, and that it manifested itself sometimes under the form of a slight acute poisoning accompanied with pallor, salivation, cold sweats, headache, vertigo, staggering, etc., which symptoms were produced in those who smoked for the first time; sometimes the poisoning was more serious, as, for instance, in the case of a man who had smoked twenty-five pipes in quick succession on a wager, who suffered for many months with vertigo. The vertigo of chronic intoxication from tobacco, he says, might be observed in the workmen and workwomen in tobacco factories, as well as in smokers, in snuff-takers, and in those who chewed tobacco. The action of nicotine varied according to the amount absorbed, and the disturbances caused in the life of the cells in consequence of their contact with the poison might also be variable. M. Le Roy de Méricourt remarked that he had never observed smokers' vertigo in Brittany or in certain other countries in which he had lived for a long time, but he had observed a tendency to syncope dependent upon disturbances of the circulation following intoxication with the ordinary tobacco.]—Russell H. Nevins.

TODDALIA.—*Toddalia aculeata*, a rutaceous plant indigenous to southern Asia, has been employed as a *tonic* in *general debility*, *chronic diarrhœa*, and *convalescence from fevers*. A tincture of the bark, particularly the root-bark, known as "Lopez root," made with 1 part of the bark to 5 parts of alcohol, may be given in daily amounts of from 90 to 300 grains.

TOKAY.—This expensive Hungarian wine is credited with being particularly efficacious as a *tonic* in cases of the *debility of convalescence*, the depression of *influenza*, *neurasthenia*, etc. An excellent wine, having nearly the same delicate aroma and taste, and doubtless possessing identical medicinal properties, is produced in California, and costs much less than the imported tokay. (See Wines.)

TOLU BALSAM, *balsamum tolutanum* (U. S. Ph., Br. Ph., Ger. Ph.), or balsam of Tolu, is a balsam obtained from *Toluifera Balsamum* (U. S. Ph.) or from the exudation which follows incision of the trunk of *Myroxylon Toluifera* (Br. Ph.). It is obtained by making V-shaped cuts in the trunk of the tree, the incisions perforating the bark. The exudation is caught in cups which are afterward emptied into flasks of rawhide, and is transported in earthen jars or tin or glass vessels. As received in the market, balsam of Tolu is soft and tenacious. With age it becomes brittle and hard like resin. It is shining and translucent, and has a yellowish-brown or reddish-brown colour. Its odour is very fragrant and it has a pungent, sweetish, but not disagreeable taste. It melts when heated, burns with a flame, and, while being consumed, emits an agreeable odour. The volatile oils dissolve it readily. The U. S. Ph. gives several tests for the purity of the drug; it must be readily and completely soluble in alcohol, the solution being acid to blue litmus paper; it must be almost completely soluble in chloroform and in solutions of the fixed alkalies; it must be almost completely soluble in ether, but nearly insoluble in water, benzin, or carbon disulphide. Carbon disulphide, aided by a gentle heat, removes from the balsam scarcely anything but its cinnamic and benzoic acids. On decanting and evaporating the disulphide, no substance having the properties of a resin should remain. The balsam is a combination of volatile oil, free acid, and resin. This oil is principally *tolene*, $C_{10}H_{16}$, the free acids being benzoic and cinnamic acids.

The medicinal properties of Tolu balsam are

very similar to those of balsam of Peru. Its taste, however, is more agreeable, and it is therefore much employed in cough mixtures, especially as a vehicle. It has long been known for its efficacy in *chronic bronchitis*. In *chronic mucous fluxes of the bronchi* and *urinary organs* it has been widely employed, and has been used with reputed good results in various forms of *chronic diarrhœa* and in *chronic dysentery*. Old *catarrhs of the bronchial apparatus* are said to have yielded to inhalations or sprays of an ethereal solution of Tolu balsam. Some forms of *skin disease* in which Peruvian balsam has been used are said to have been equally benefited by Tolu balsam. It has been applied to *suppurating* or *inflamed areas*, mixed with equal parts of castor oil, with alleged success.

In doses of from 10 to 30 grains, frequently repeated, it has been principally employed in the bronchial disorders above mentioned. It forms an element of many cough mixtures, its principal use, as a vehicle, being in favour not only because of its direct beneficial influence, but also on account of its agreeable taste. It may be given in the form of emulsion made by rubbing up the balsam with mucilage and sugar and afterward with water.

Syrup of Tolu, *syrupus tolutanus* (U. S. Ph., Br. Ph), contains 2 fl. oz. of tincture of Tolu, 120 grains of carbonate of magnesium, 26 oz. of refined sugar, in coarse powder, and a pint of water (U. S. Ph.). The British syrup contains 1½ oz. of balsam of Tolu, 2 lbs. of refined sugar, and a pint of distilled water. The syrup of Tolu is a very feeble preparation and has but little of the therapeutic virtues of the balsam. It is used principally as a flavouring element for mixtures. A stronger syrup may be made by adding a desired amount of the tincture of Tolu. The dose is ½ fl. oz.

Tincture of Tolu, *tinctura tolutana* (U. S. Ph., Br. Ph.), is made of the balsam of Tolu and alcohol in the proportion of 1 to 10. It possesses the therapeutic properties of the balsam and may be used in place of the latter whenever it is indicated. It is frequently employed in *chronic bronchitis*. The dose is from 1 to 2 fl. drachms. It may be used as a flavouring medium. The tincture becomes decomposed on the addition of water.

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TOLUENE, TOLUIDINE, TOLUOL, or *methylbenzene*, C_7H_8, is a colourless liquid having the odour of benzene. It is obtained by the fractional distillation of the purified light oils of coal tar. Besides its use in thermometer tubes in place of mercury, over which it is said to have some advantages for certain ranges of temperature, it has been employed in medicine. Professor Löffler, of Greifswald (cited in the *Ephemeris of Materia Medica*, etc., for January, 1896), has found that it kills the micro-organism of *diphtheria*, and he has treated that disease by topical applications of the following mixture (*American Journal of Pharmacy*, March, 1895), in which the menthol serves to deaden the pain that would otherwise be caused:

℞ Menthol ..... 10 grammes;
Toluol, enough to make 36 c. cm.;
Alcohol..... 60 c. cm.;
Solution of ferric chloride (of a strength not stated)..... 4 c. cm.
M.

In a series of seventy-one cases, all the patients were saved; in another of twenty-six cases, treated after the second day of the disease, only one patient was lost.

TOLYLANTIPYRINE. — See TOLYPYRINE.

TOLYLHYPNAL. — Antipyrine hydrochloride (see ANTIPYRINE).

TOLYPYRINE.—This is the tolyl analogue of antipyrine, $C_6H_4CH_3N\langle^{COCH}_{NCH_3.CCH_3.C_7H_6O_2}$, tolyl being substituted for phenyl. It has the same medicinal properties as antipyrine, and is used in the same doses. It has the advantage of being cheaper than antipyrine. The salicylate, or *tolysal*, $C_6H_4CH_3N\langle^{COCH}_{NCH_3.CCH_3.C_7H_6O_2}$, which is almost insoluble in water, but readily soluble in alcohol, has been used to some extent as an *antipyretic* and *analgetic*, particularly in *rheumatism* and *rheumatic neuralgia*, in doses of from 15 to 30 grains.

TOLYSAL.—Tolypyrine salicylate (see under TOLYPYRINE.)

TONGA is a somewhat uncertain preparation of barks found in the Fiji Islands which has been employed to some extent in the treatment of *neuralgia*, but the evidence in favour of its remedial properties is not very great. It is used in the shape of an unofficial fluid extract of which the dose is from ½ to 1 fl. drachm.—RUSSELL H. NEVINS.

TONGALINE.—This is an American proprietary preparation said to be made from tonga, cimicifuga, sodium salicylate, pilocarpine salicylate, and colchicine salicylate. It has been used in *rheumatism*, *neuralgia*, *influenza*, *gout*, and *nervous headache*.

TONGUE TRACTION.—See under ANÆSTHETICS (vol. i, p. 64.)

TONICS are measures which are employed for the purpose of restoring permanent energy or tone to weakened, impaired, or diseased organs or systems of organs or the organism at large. One may compare the action of tonic drugs in their gradual production of vital force or tension in a weakened or degenerated system to the strings of a musical instrument which do not give forth their proper notes unless put upon the proper stretch or under proper tension. An impaired system acted upon by appropriate tonics will, if it still has the power of reaction, gradually begin to respond to "its natural and appropriate stimuli." The great difference between tonics and stimulants lies in the fundamental notion that the latter are called upon for sudden and temporary excitation of organs which require some measure to tide them over a crisis, or to excite to action some organ which is lagging behind physi-

ological necessity, or to repel the invasion and triumph of some grave systemic enemy. Stimulants are essentially ephemeral in their results and are administered only until physiological demands are met and the innate forces of the vital functions are capable of proceeding alone. Tonics, on the other hand, are given in emergencies of another nature. Their purpose is to combat debility which does not threaten life, necessarily, but which interferes with the normal action or reaction of a system of the body or of the entire organism.

An organ may be perfectly developed and healthy, but the vital force necessary for it to fulfil its physiological purpose may be deficient. This force, on the contrary, may be unimpaired, it may even be greater than is required, but the organ on which it is expended may be lacking in healthful tone or may not have reached its necessary development. In either case, the physiological function intended is incapable of being carried out. Again, there may be debility due to weakness of muscular development or lack of muscular strength, or the system's impairment may make itself manifest in the nervous system. These, in turn, may find the source of degeneration in an enfeebled or languid circulation or in a depreciated condition of the blood. But these vascular faults, unless they are essential, may have their origin in deficient nutrition, which may spring from improper assimilation, a lack of appetite, or disturbed or imperfect digestion of food. The development of toxines in the circulating fluids, originating from an insufficient excretion of the waste products of metabolism, may, on its part, be responsible for the existing debility. Finally, disease of any kind, functional or organic, and the strain involved in the complexity of modern life, may rob the system, or a part of it, of its "tone." The source, it will be seen, must be the seat of attack; and in every case in which debility is a feature, the origin, whether in disturbed nutrition or impoverished blood, must be the point toward which therapeutic measures must be directed.

Aside from the strict therapeutic indications which point to the use of tonics, they should find no place in the armamentarium of the physician, for it is a peculiar fact that frequently, when improperly administered or administered to healthy persons, they are apt to produce symptoms of a disagreeable nature. This is particularly true of the class of drugs known as vegetable bitters, which are gastric tonics, and another strong contra-indication to their employment is a febrile condition, because, in this state, they easily upset the stomach and have a tendency to increase the number of the heart's beats without lowering the blood-pressure.

Broadly speaking, tonics may be regarded as *general* and *specific*, depending upon the effect they have upon the entire organism or an individual organ, although the fact must always be kept in mind that many of the general tonics are specific in their action, and *vice versa*. The specific tonics, again, may be grouped under several heads, such as *cardiac tonics*, *vascular tonics*, *gastric tonics*, and *nervous tonics*, including spinal and cerebral excitants. Each of these specific tonics may be general in its remote influence after having executed its specific effect, but it must not be forgotten that the toning-up process is a slow and gradual one and that immediate results must not be expected.

Among the general tonics, those which act upon the nervous system play an important part. The *heavier wines*, *arsenic*, alone or in combination with *strychnine* and *quinine* or *strychnine* and *iron*, the various *malt extracts*, and *beer* and *porter* take high rank. But some of these act upon the stomach, the blood, and the heart also, and the difficulty of laying down strict lines of distinction will be at once apparent. *Iron*, although in a sense a vascular tonic, is a general tonic in that it makes good the lack of energy and vital force in *anæmia*. *Quinine*, again, though a specific tonic in *chronic malarial poisoning* and *malarial paroxysmal diseases*, becomes general in its influence by depriving the system of a source of intermittent or persistent poisoning. *Strychnine* and the preparations of the *hypophosphites* and of the *phosphates* are, under proper indications, reliable and valuable general tonics.

Under *cardiac tonics* are included all those substances which increase the force of the heart's beats and regulate its rhythm. They may be called for in organic or in functional disturbance of the heart's action. The main ones are *digitalis* and its derivatives, *convallaria maialis*, *strophanthus*, *adonis vernalis*, *caffeine*, *sparteine*, and *nux vomica* and its alkaloid, *strychnine*. (Compare CARDIAC STIMULANTS, TONICS, and DEPRESSANTS.)

The *vascular tonics* are, principally, *strychnine*, *digitalis*, and *iron*, which act by raising the blood-pressure through the augmented contraction of the capillaries and arterioles which they produce. Their influence upon metabolic processes rests upon the change in the quantity of lymph poured into the tissues secondarily to their effect upon the smaller blood-vessels. Under the group of *gastric tonics* must be embraced those medicines which make for an increase of appetite and whose influence is to assist gastric digestion. Many of these depend for their activity upon the bitter element which they contain, although it does not seem to be essential. Among them may be mentioned *quinine*, *quassia*, *gentian*, *cinnamon*, and many other aromatic drugs. *Strychnine* represents the class of *spinal tonics*, whose function is described in their title. In the employment of tonics it is essential to bear in mind the interdependence of the various organs and the relations between metabolism and excretion.

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TONQUINOL.—This is a variety of artificial musk made in Leipsic. It is about a third cheaper than Baur's artificial musk. It is not pretended that it has any of the medicinal virtues of musk.

TORMENTILLA.—The root-stock of the European rosaceous plant *Tormentilla silvestris* is *astringent* and was formerly known as

German rhatany. It has been used in *dysentery* and *dysenteric diarrhœa*. The dose of the powder is from ½ to 1 drachm.

TOUCHWOOD.—Agaricus chirurgorum. (See under AGARIC.)

TOXALBUMINS.—See TOXINES.

TOXICODENDRON.—*Rhus Toxicodendron* (see vol. ii, page 131).

TOXINES.—The first experiments in the toxine treatment of malignant tumours were made in 1892 by Spronck, of Utrecht, and published in the *Annales de l'Institut Pasteur*, October, 1892. My experiments were begun in December, 1892, and were the gradual outcome of investigations commenced in May, 1891, as to the nature and effect of repeated inoculations of the living streptococcus of erysipelas upon malignant tumours. The idea of combining the *Bacillus prodigiosus* with the streptococcus was suggested to me by the experiments of Roger, which proved that the *Bacillus prodigiosus* had the power of intensifying the virulence of the streptococcus of erysipelas. This combination had never before been used or suggested with reference to malignant tumours. The effect of combining the toxines was to greatly intensify the reaction, and a large number of experiments proved that the antagonistic and curative action of the erysipelas was likewise increased by the addition of the *Bacillus prodigiosus*.

During the past four years I have treated upward of a hundred and sixty cases of malignant tumours by this method. Several changes have been made in the technics of the preparation, but the following method of preparing the toxines has thus far proved the most satisfactory:

Method of Preparation of the Toxines.—To make the toxines of erysipelas and of the *Bacillus prodigiosus*, ordinary peptonized bouillon is put into small flasks, containing 50 to 100 c. cm., which, after proper sterilization, are inoculated with the streptococci of erysipelas and allowed to grow for three weeks at a temperature of from 86° to 95° F. The flasks are then inoculated with the *Bacillus prodigiosus* and the cultures allowed to grow for ten or twelve days more at room temperature. At the end of that time, after being well shaken up, the cultures are poured into sterilized glass-stoppered half-ounce bottles, and heated to a temperature of from 122° to 140° F. for an hour, so as to render them perfectly sterile. After they have cooled, a little powdered thymol is added as a preservative, and the toxines are ready for use. The toxines when prepared in this way are very much stronger than when filtered through a Pasteur, Chamberland, or Kitasato filter, the active principles contained in the germs themselves being preserved. If, as is sometimes the case, the preparation is found to be too strong to use with safety, it can be diluted with glycerin or sterilized water.

The best method of making the bouillon is to soak a pound of chopped lean meat over night in water. In the morning strain it through a cloth, make up to 1,000 c. cm., and boil for an hour. Then filter through a cloth, add peptone and salt, neutralize, and boil again for an hour. The bouillon will then pass through filter-paper perfectly clear, and be ready to put into the flasks. It is not, however, necessary to neutralize the bouillon, as the streptococci will grow even more readily in acid bouillon, and the resulting preparation is, if anything, stronger than when neutralized bouillon is used.

Results.—Of the cases treated, ninety-four were sarcoma, thirty-eight were carcinoma, twenty-three were epithelioma, and ten other tumours were undoubtedly malignant, but their exact nature had not been determined by microscopic examination.

Of the sarcomas, fourteen were spindle-celled, fifty-two round-celled, seven melanotic, and the others mixed-celled. In nearly half these cases more or less improvement was shown. In many of them the improvement was very striking, in others slight and temporary in character. The variety that showed the greatest improvement was the spindle-celled, and that which showed the least was the melanotic. The round-celled type of sarcoma was also but little affected by the toxines.

The effect of the mixed toxines upon *carcinoma* was far less striking than it was upon sarcoma. In a certain small proportion of cases, especially in *epithelioma*, there was very great improvement, which in three cases resulted in the entire disappearance of the tumour. In one of these cases, one of epithelioma of the chin, the lower jaw, and the floor of the mouth, the patient is now well, two years after treatment. In the second case, one of recurrent carcinoma of the face involving the lower eyelid, the patient remained well for a year, when it recurred; it was placed under further treatment with improvement. The third case was a twice recurrent carcinoma of the breast. In this instance the treatment was continued for a year and a quarter before the disease was got under control. The patient is well at present, a year and a half from the beginning of treatment. But in all these cases of carcinoma the time has been manifestly too short to make it possible to regard them in any sense as cured. These cases, together with others, however, in which a marked temporary improvement occurred, are sufficient to encourage us in conducting further experiments. The chief value of the toxines in carcinoma will probably be found to lie in their use as a prophylactic measure against recurrence after primary operations. Their value in this respect, however, can only be determined by years of experimenting.

Sufficient time has elapsed to prove that the toxines are really curative in a certain proportion of cases of "*inoperable*" *sarcoma*. Four patients have now remained well from two and a half to upward of four years after treatment. All these cases were entirely beyond operation, and the diagnosis was confirmed clinically and microscopically by leading surgeons and pathologists. The case in which the patient has remained well for more than four years can not properly be classed as a cure from the toxines, as it was treated by repeated injections of the

living germ and actual erysipelas was produced. Nearly every case of spindle-celled sarcoma treated was either cured or showed very great improvement. In one case of mixed-celled sarcoma, recurrent, the patient was well three years and a quarter after treatment. Recurrence in this case occurred three years and a half afterwards; in one case of spindle-celled sarcoma, three years after treatment; in another, two years and nine months; and in a third, two years. The method has been employed only in "inoperable" cases.

The value of the toxines depends almost entirely upon the virulence of the cultures from which they have been prepared. Great difficulty has been experienced in obtaining suitable cultures and keeping them sufficiently virulent. Most of the successful cases were treated with toxines obtained from fatal cases of erysipelas. The cultures rapidly lose their virulence after a few generations unless they are frequently passed through animals.

The toxines are very powerful bacteriological products and need to be used with the utmost care to be free from danger. I have had three cases in which death was caused or undoubtedly hastened by the injections. In all these cases, however, the disease was so far advanced that death could not have been postponed more than a few weeks without the treatment.

In the early cases treated with the toxines the filtered preparations were used. Later experiments showed that much better results were obtained by using both the soluble and insoluble products, or, in other words, the unfiltered mixed toxines prepared by subjecting them to sufficient heat to render them sterile. This was found to be from 136·4° to 140° F. The toxines prepared by this method from virulent cultures are extremely powerful. Doses of from $\frac{1}{4}$ to 1 minim, when injected into the substance of the tumour, usually produce a reaction temperature of from 101° to 104° F. It is important to note that much larger doses can be safely borne when injected subcutaneously, remote from the tumour, the reason probably being that the toxines are more quickly absorbed when injected into the tumour substance. Individuals vary considerably in their susceptibility to the action of the toxines. Therefore it is always wise to begin with the minimum dose and gradually increase it, the temperature reaction being the chief guide in determining the dose. If no improvement has been noted after two or three weeks' treatment it will not be likely to occur at all. As to the length of time the treatment should be continued this is impossible to state definitely. In several of the successful cases a cure was only obtained by persistent and long-continued efforts; and it is quite possible that in some of the cases in which the sarcoma disappeared and subsequently recurred a permanent cure might have resulted had the treatment been continued for a longer period of time.

The local and constitutional effects of the toxines are, briefly, as follows: The introduction of the fluid into the tumour causes a burning sensation which lasts but a short time. There is at first increased hyperæmia in the neighbourhood of the injections. This, however, at the end of from twelve to twenty-four hours gives place to well-marked anæmia, the tumour resuming a characteristic bluish colour. After several injections, in favourable cases, the circulation of the tumour becomes so much impaired that actual necrobiosis occurs and the degenerated tissue is either absorbed or breaks down and comes away in the form of a slough. In the spindle-celled variety, in which the fibrous elements predominate over the cellular, disappearance by absorption is more likely to occur, while in the round-celled sarcomata the reverse is generally the case.

In regard to the constitutional effects, the reaction depends largely upon the dose administered; slight headache and malaise are the only symptoms noted after a small dose. Larger doses are followed by a chill varying in intensity and coming on within from fifteen minutes to two hours after the injection. In some few instances the chill may not set in until five or six hours after the injection, but if severe in character it is likely to occur within an hour from the time of injection. The duration of the chill varies from ten to forty minutes, according to its severity. The temperature rapidly rises after the chill has subsided to from 101° to 105° F.; in some few cases it has reached 106° and upward. The heart's action is correspondingly increased; the pulse-rate varies from 120 to 160; nausea, frequently vomiting, and intense headache usually accompany a severe reaction. Profuse perspiration soon follows and the temperature falls rapidly and, as a rule, will have returned to normal within from six to twelve hours after the chill.

The effect of the injections upon the pain caused by the tumour is in many cases very striking, making it possible to do away with morphine entirely. The beneficial influence of the toxines upon the tumour corresponds to the severity of the reaction. Experience has proved, however, that the best results are more likely to be obtained by giving doses sufficient to cause but moderate reaction—for example, a temperature of from 101° to 103°—and then repeating them frequently every day or every other day according to the physical condition of the patient and the way in which they are borne.

In regard to the various theories that have been advanced in explanation of the action of the toxines upon malignant tumours, I will only say that I still adhere to the opinion expressed in my earlier publications that the microparasitic origin of malignant tumours furnishes the most rational ground for explaining the action of the toxines.

A number of successful cases of sarcoma treated by this method have been reported by other surgeons. The more important of these cases will be found in my most recent paper, in the *American Journal of the Medical Sciences* for September and October, 1896.

TABLE SHOWING VARIETIES OF TUMOURS SUCCESSFULLY TREATED BY THE TOXINES, WITH FINAL RESULT (PERSONAL CASES).

Sarcoma, spindle-celled.	7 cases; 1 recurred 1 yr., 1 recurred 1½ yr.	Five well without recurrence 4, 3, 2½, 2, ½ yrs.
Sarcoma, round- and mixed-celled.	1 case.	Well 3½ yrs.
Sarcoma, round-celled.	2 cases.	Well 1 and 2 yrs.
Chondro-sarcoma.	1 case; recurred 8 mos.	
Osteo-sarcoma sacrum.*	1 case.	Well 1 yr.
Epithelioma.	2 cases; 1 recurred ½ yr.	One well 2 yrs.
Recurrent carcinoma, breast.	1 case.	Well 1½ yr. after beginning of treatment 3 mos. after end.

[Dr. Lewis A. Stimson, Dr. Arpad G. Gerster, and Dr. B. Farquhar Curtis, constituting a committee appointed by the New York Surgical Society to investigate and report upon the erysipelas-toxine treatment of malignant growths, say in their report (*Annals of Surgery*, July, 1896): "Both before and since our appointment as a committee, we have been able to observe, individually and together, a considerable number of cases treated by this means, and in no case have we found any amelioration which held out a prospect of ultimate cure. We have, on the contrary, observed in some cases that the rate of growth of the disease was much more rapid during the treatment. The treatment also imposes a very severe tax upon the strength of the patient, and apparently hastens the cachexia in most cases.

"We believe that in the instances of apparent cure or marked improvement the correctness of the diagnosis is open to doubt.

"We therefore submit:

"1. That the danger to the patient from this treatment is great.

"2. Moreover, that the alleged successes are so few and doubtful in character that the most that can be fairly alleged for the treatment by toxines is that it may offer a very slight chance of amelioration.

"3. That valuable time has often been lost in operable cases by postponing operation for the sake of giving the method of treatment a trial.

"4. Finally, and most important, that if the method is to be resorted to at all, it should be confined to the absolutely inoperable cases."

The committee's views are properly conservative and in accord with the spirit in which Dr. Coley's experiments have been carried on. As he himself says, only a large experience can determine the exact value of the toxine treatment. Already some notable reports of observations by capable clinicians have been published, as the following examples will show:

Czerny relates his experience in the *Münchener medicinische Wochenschrift* for September 3, 1895, and his account is summarized in the *British Medical Journal* for October 12, 1895. Although he has often seen no good effect, but even a more rapid development of tumours, after a casual erysipelas, yet he recollects two cases in which an undoubted beneficial influence was exerted upon carcinoma. He has used the mixed erysipelas and *Bacillus-prodigiosus* toxines after Coley's method. In the case of a woman aged thirty-five a sarcoma of the parotid appeared during pregnancy, and grew at first slowly, but later rapidly. When she presented herself there was a mass as large as the fist behind the ear, the parotid was hard, and a mass of growth was present in the external auditory meatus. The facial nerve was paralyzed. As extirpation offered no hope, the toxine treatment was begun, and eighteen injections were made. The growth became greatly lessened in size, the parotid gland grew soft, and the facial paralysis disappeared except from the frontal branches of that nerve. Czerny says that a marked favourable if not specific action upon the sarcoma was noted in this case. It is to be remembered, says the writer, that tumours occurring during pregnancy have sometimes been known to diminish considerably afterwards. Czerny then refers to three cases of recurrent sarcoma in the naso-pharyngeal space in which he used the same treatment, but the number of injections was too small to produce a very striking effect. He has also treated four cases of carcinoma with no very real benefit. In one case of advanced carcinoma of the upper jaw an extensive softening of the growth with subjective improvement occurred. Putting his results alongside Coley's more extensive experiences, he concludes that (1) the injection of these toxines causes fever, etc., and always local inflammatory signs; (2) these manifestations disappear in a few hours, but after frequently repeated injections there may be loss of appetite, wasting, etc.; (3) the injections exercise a specific action upon sarcomatous growths, and may even bring about a cure; (4) as the results are uncertain, such treatment should of course never take the place of an operation, but should be adopted in "inoperable" or recurrent growths. Perhaps it might be used to prevent recurrence in sarcoma; and (5) in carcinoma at most a retardation of growth has been noted, but no cure.

In the *Wiener medizinische Blätter* for August 27, 1896, there is an abstract of an account, originally published in the *Gazette médicale de Liége*, of observations on this treatment by Matagne, of Brussels. He has employed it in fourteen cases, and maintains that in one of them a complete cure was accomplished. The patient was a man, sixty-four years old, who in January, 1895, first noticed something abnormal in his mouth. In February he consulted a physician, who diagnosticated epithelioma and advised an operation, to which the patient did not consent. Many other physicians saw the patient, and they all concurred as to the diagnosis and urged the man to have an operation performed. Early in June the patient consulted Dr. Matagne. By this time he had a three-lobed tumour

* No microscopical examination in this case.

which occupied the floor of the mouth. The largest lobe was as large as a nut; in the left submaxillary region there was a gland as large as a small nut—the kind of nut is not specified in either instance—and under the chin there were two other glands the size of a bean. The tumour was hard and ulcerating, but without suppuration, and lancinating pains proceeded from it toward the left ear. In a short time the symptoms were so marked that nobody who saw the man had a doubt of the epitheliomatous nature of the growth. However, no histological examination of the neoplasm was made, for fear of opening a channel for secondary infection.

The treatment was begun on the 10th of June. Five centigrammes of the toxine were injected beneath the skin of the neck below the hyoid bone. In two hours the man's temperature was 101·3° F. On the 16th of June forty centigrammes were injected into the tumour, and hard swellings made their appearance in half an hour; the tongue remained quite swollen for two entire days. The highest temperature reached during the treatment was 105·8° F. During the whole febrile period the tumour diminished in size very decidedly, and the diminution kept on after the subsidence of the fever, so that by the beginning of September not a trace of the growth remained.

Another case was one of recurrent sarcoma of the neck in a woman seventy-eight years old. The tumour was as large as an egg and situated in front of the sterno-cleido-mastoid muscle. Another tumour, of the size of a hazelnut, was seated in the masseteric region, and two small but very hard glands were to be felt under the chin. After a course of treatment lasting three months and a half, the injections being given every second day, the large tumour had wholly disappeared and the one in the masseteric region could hardly be felt, but the enlarged glands had not undergone complete involution, when the treatment was accidentally interrupted. In six months after its discontinuance there was a moderate aggravation of the disease, and the patient was advised to submit to the injections again.

In a third case, one of recurrent sarcoma of the neck of the size of a fœtal head, the patient was treated with the toxines for three months, and the tumour had then shrunk to two thirds of its original size. The patient, out of patience with the long duration of the treatment, decided to call in a surgeon, who operated with a fatal result. In a case of recurrent sarcoma of the arm the injections checked the growth of the tumour only temporarily. In one of sarcoma of the pharynx no result was noted other than a brief restraint of the growth.

The sixth case was one of deeply ulcerated sarcoma of the neck in a very debilitated man, sixty-four years old, who died during the reaction following an injection of ten cubic centimetres of the toxines after the treatment had been carried on for five weeks. The tumour had diminished in volume a little. The seven other cases were all examples of epithelioma or carcinoma, and, save in two of them, the results were but very slight. In one of these two, a recurrent carcinoma of the breast, the injections seemed to check the growth of the tumour, for it remained stationary for several months; in the other, a uterine carcinoma, there was alleviation of the pain together with reduction of the size of the tumour, and the improvement lasted for four months.

Dr. Henry L. Shively, of the Presbyterian Hospital Dispensary (*New York Medical Journal*, December 12, 1896), appends to a report of a case of sarcoma treated by him with the mixed toxines of *Streptococcus erysipelatis* and *Bacillus prodigiosus* the following remarks: "It is believed that an impartial survey of the facts here recorded can not but convince one that there was an immediate and pronounced influence of the toxines in causing retrogression and absorption of the tumour mass, and, although a cure was not effected, yet the patient's urgent and distressing symptoms were relieved, he gained for a time in flesh and strength, and his life was probably prolonged. When the pitiable hopelessness of his condition is considered then, the results of treatment can not be deemed an entire failure. It is also apparent from the symptoms following the second injection that the toxines may act as a powerful poison, having a direct paralyzing effect upon the respiratory centre. Notwithstanding, however, its possible dangers and the uncertainty of its action, the toxine treatment constitutes at present our only therapeutic resource for inoperable malignant disease having well-authenticated cases of recovery to its credit. Should not the patient have the benefit of its trial?"

Dr. Eugen Hirschfeld (*Australasian Medical Gazette*, March 20, 1896; *New York Medical Journal*, May 23, 1896) has written partly concerning a variation of the toxine treatment—namely, the use of the *serum of animals infected with erysipelas;* nevertheless, all that he reports has a direct bearing upon the Coley treatment. He first refers to the researches of Emmerich and of Scholl, based on the fact, established by repeated observations, that malignant tumours had been found to disappear in some patients who, while suffering from the tumours, were accidentally infected with erysipelas. In order to produce by treatment what had occurred by accident, Neisser and Fehleisen inoculated in cases of hopeless cancer with pure cultivations of virulent erysipelas cocci, but they soon gave it up on account of the many untoward accidents connected with the method. Professor Bruns reported a case of melanosarcoma of the mamma of the most malignant type in which extirpation was done. The disease recurred before the wound healed, and at about the same time the patient became infected with a serious wandering erysipelas, with the result that the new growth disappeared without leaving a trace behind. Six years later Professor Bruns was able to state that the patient had remained cured. In looking over the literature on the subject, Professor Bruns, says Dr. Hirschfeld, found three cases of undoubted complete and permanent cure of

sarcoma by natural or artificial erysipelas, but he states emphatically that there was no case of carcinoma in which the cure had been established beyond all doubt. Successful observations were communicated also by Biedert and Bush; but Emmerich was the first who undertook to put the matter on an experimental basis, as early as in 1886. He obtained the following results:

1. Acute cases of *anthrax* in animals can be cured by inoculation with erysipelas cocci.

2. The curative power of the erysipelas cocci is not centred in the cocci themselves, but in certain changes brought about in the blood under its influence, so that it obtains antibacterial qualities.

3. The blood serum of animals infected with erysipelas possesses the same curative powers as the erysipelas coccus itself.

As cancer is limited to the human species, says Dr. Hirschfeld, it was impossible to carry out similar experiments in animals; but, as they had found that the injection of blood serum of beasts infected with erysipelas was as efficient as the inoculation with the erysipelas coccus itself, while on the other hand it was not accompanied by the same serious symptoms as the inoculation, they concluded to try it in human beings in such cases as were beyond the reach of operation.

The number of patients suffering from malignant tumours (*carcinoma*, *sarcoma*, and *lymphoma malignum*) who have been treated thus far with the erysipelas serum has been comparatively small, and the results obtained by different observers extremely contradictory. *A priori*, says Hirschfeld, we must remember that the time that has elapsed is altogether too short to allow a definite opinion to be formed on the subject. The beginning of the serum treatment of cancer dates back only as far as the beginning of the year 1895. Even suppose all the patients had been cured by the injection of the serum, he says, we should certainly allow a much longer time to elapse before we could pronounce them completely and permanently cured. In two successive publications, Emmerich, Scholl, and Zimmermann report altogether eleven cases with partial or complete temporary success. It is very much to be regretted, Hirschfeld thinks, that the authors do not state the total number of patients who were treated by the new method, as we certainly get the impression, when reading their communications, that the number of patients reported is very small in proportion to the number who have been treated. They mention only that the erysipelas treatment had been without effect in two cases of far-advanced carcinoma in which secondary infection was accompanied by extensive ulceration.

Of these eleven patients, eight were suffering from carcinoma—seven of which were located in the mamma—one from epithelioma, one from sarcoma fusicellulare of the thigh, and one from sarcoma of the face. The diagnosis was established by microscopical examination, and most of the patients had been operated upon repeatedly without any success by leading German surgeons, and had been handed over to Emmerich for the serum treatment as hopeless.

In two instances the original tumour disappeared entirely, while in all a great diminution in size and improvement in general appearance, like cicatrization, were observed. The very great improvement in general health, says Dr. Hirschfeld, is of minor value, as the mental effect alone of a remedy that promises cure to a hopeless patient would be sufficient to bring that about.

The results obtained by Professor Bruns in Tübingen, he says, are very much less satisfactory, although he used serum sent by Emmerich. He subjected six patients to the treatment. Four were suffering from carcinoma, one from lymphoma malignum, and one from sarcoma. A diminution in the size of the tumour did not take place in any single instance. The treatment was eventually broken off on account of several serious symptoms arising from it. In three patients, immediately after the injection, attacks of dyspnœa, cyanosis of the face, heart palpitations, and vomiting supervened. In another case the rise of temperature which generally follows the injection developed into fever lasting for eight days, with severe pains in the joints. The appearance of albuminuria and numerous granulated cylinders in the urine compelled Bruns to discontinue the treatment in the fifth patient.

It must be pointed out, however, continues Dr. Hirschfeld, that the serious complications mentioned may be due to accidents which it should be possible to avoid. The continued high fever may be due to an imperfect sterilization of the serum. The sudden attacks of dyspnœa were caused, as Emmerich suggests, by the accidental insertion of the injecting needle into a vein, thus flooding the circulation at once with the whole of the serum; he himself met with the mishap but once.

Dr. Hirschfeld cites several cases in which the erysipelas treatment was employed with varying results. He has endeavoured to collect all the material that is available in the literature on this subject, he says, and, after a review of the whole matter, including his own observations, he comes to the following conclusions:

1. The injection of erysipelas serum into patients suffering from malignant new growths produces a reaction which consists in a rise of temperature, accompanied by a corresponding increase of frequency of pulse, which generally returns after a short time to the normal.

2. The influence upon the tumour itself is very distinct. The serum induces a change, the principal characteristic of which is retrogressive metamorphosis, which begins with a fatty degeneration of the cellular elements composing the tumour, leading to melting down and afterward, in some cases, to the entire absorption of the new growth.

3. If due care is taken in its preparation, the injection of erysipelas serum is not followed by the appearance of erysipelas.

4. The action of the serum, according to all observers, is more powerful in sarcoma than in carcinoma. Even melanotic sarcomata of the

most malignant type may be made to disappear under the influence of the erysipelas toxine.

5. The serum signally fails in some cases to benefit the patient, although the injection is followed by the usual reaction.

6. The untoward accidents connected with the treatment which have been observed so far are—(*a*) severe rigour, lasting for thirty-five minutes, followed by rise of temperature up to 104·4° F.; (*b*) severe dyspnœa, cyanosis, vomiting, and palpitation of the heart, lasting from ten minutes to half an hour; (*c*) the appearance of albumin and cylindrical casts in the urine; (*d*) continued remittent fever.

7. These accidents are caused—(*a*) by the serum not being in a sterile condition; (*b*) by the insertion of the injecting needle into a blood-vessel; (*c*) by variation of different kinds of the serum not explained hitherto.

8. The principal points of interest for the general practitioner are, whether it will be possible to avoid these accidents in future. We can easily dismiss the second point, the insertion of the injecting needle into a blood-vessel. If attention is only drawn to the existence of this danger we shall be able in most cases to elude it by ordinary care.

With regard to the serum not being in a sterile condition when used, says Dr. Hirschfeld, a good deal of bacteriological experience is required in the operator to avoid this risk. Perhaps, he says, it would be possible to do away with it altogether by adding an antiseptic (0·5 per cent. of carbolic acid) to the serum, as in the case of the diphtheria antitoxine. A further concentration of the serum is necessary, however, if this plan is carried out, he adds, or otherwise too great a quantity of carbolic acid would be injected at the same time, which by its chemical action might possibly have an injurious influence and interfere with the action of the antitoxine.

The third point, the apparently unexplained variation of different kinds of serum, is the most serious, and one, he says, that most of those who have used the serum have experienced. Emmerich and Scholl mention that the difference in breed of the sheep used for the experiments has been one cause. It is certainly advisable, Dr. Hirschfeld thinks, to get the original serum from Germany, although the difficulties in bringing the serum to the proper standard have not been quite overcome yet. Besides, it is not at all certain whether it would keep. Professor Bruns experimented with serum which he had received from Emmerich himself, and albuminous deposits which contained micro-organisms were found to have formed within a few days. The addition of an antiseptic might overcome this. One way of lessening the danger would be to inject a certain quantity of each supply into an animal, and to reject it altogether if an abnormal rise of temperature was observed to follow.

9. The efficiency of the serum treatment may be increased, as has been shown by Emmerich and Zimmermann in their last communication, by following it up with the inoculation of the erysipelas coccus itself. The previous injection of the antitoxine makes the subsequent infection run a more benign course. The success achieved by the authors, in a far-advanced case of cancer of the tongue, with secondary infiltration of the submaxillary and cervical glands, has certainly been most remarkable.

The method of the treatment of malignant tumours by the injection of erysipelas serum, though far from being perfect, says Dr. Hirschfeld, has been successful in some otherwise absolutely hopeless cases, and it promises to do more, and has done more, than any other treatment at our disposal.

Dr. W. A. Thiele (*Annalen der russischen Chirurgie*, 1896; *Centralblatt für Chirurgie*, October 3, 1896), on the strength of four cases of his own and a case of Emmerich's in which Emmerich and Scholl's erysipelas serum was used, comes to the following conclusions: 1. Complete cure with the serum has not been demonstrated. 2. The injections are free from danger, but not from inconvenience, for they occasionally give rise to headache, weakness, fever, etc. 3. The cancerous nodules grow smaller and occasionally disappear, and ulceration is checked. 4. Where an operation is impracticable, the serum should be used, for it mitigates the pain and thus takes the place of narcotics. 5. It is very desirable that the remedy should be employed systematically in cases of incipient malignant tumours.

Dr. Robert H. Greene, of the City (Charity) Hospital (*Medical News*, October 10, 1896), has observed temporary benefit from the employment of the mixed toxines in *syphilis*, as has been known to follow a casual attack of erysipelas.] WILLIAM B. COLEY.

TRAGACANTH, *tragacantha* (U. S. Ph., Br. Ph., Ger. Ph.), is a gummy substance obtained from various species of *astragalus*. It is soluble with difficulty in water. It is used in the preparation of troches and similar bodies. Its solution may be employed in the administration of insoluble powders which are held in suspension in it. Otherwise it is not used in medicine, except occasionally as a *demulcent*. The official mucilage, *mucilago tragacanthæ* (U. S. Ph., Br. Ph.), is employed chiefly as an excipient in making pills; so is the *glycerinum tragacanthæ* (Br. Ph.), which is a jellylike mass. The compound powder, *pulvis tragacanthæ compositus* (Br. Ph.), may be given in doses of from 20 to 60 grains, rubbed up with water.—RUSSELL H. NEVINS.

TRANSFUSION AND INFUSION.—The history of transfusion and that of infusion are inseparable. Both are procedures which have for their intention the introduction of foreign material into the blood for life-saving purposes; in the case of transfusion it is the blood of another individual, in the instance of infusion it is a fluid with therapeutic qualities, nourishing or stimulating, or simply intended to fill depleted blood-vessels.

The widespread belief that the blood is the seat of the soul was undoubtedly the incentive, during ancient times and the Middle Ages, to improve or to repair the condition of the vas-

cular fluid. Virgil asserts that with the loss of blood the soul escapes. In Ovid's Metamorphoses the ancient legend of the restoration of Æson from age to youth by his daughter-in-law, the sorceress Medea, is related. This change was accomplished by allowing his blood to escape through a wound in the neck and substituting for it a mixture containing numerous ingredients. Part of this she introduced through the wound, part by the mouth. In the Odyssey mention is made of the prevalent belief that by the drinking of freshly-drawn blood the dead might be made to resume their mental activities. The Bible contains several references to the fact that the soul is in the blood, and Aristotle, Empedocles, Galen, and Lucretius Carus lend their august names to the same faith. Even if we may not assume that an actual transfusion or infusion had been done in these early times, we are justified in believing that the notion of its possibility and of its value existed. For centuries the myth has had a hold upon the people that the drinking of blood has the power of eliminating disease and of imparting new strength and power to the body. The imbibition of blood was an agent for the cure of epilepsy in good repute up to almost recent times, and most of the old works on therapeutics, even to the beginning of the present century, mention mixtures for the cure of diseases of every kind in which blood is an important and almost ubiquitous component element.

The first direct transfusion of blood is probably to be attributed to Cardanus, in 1556. He speaks of the belief being prevalent at that time that age could be made to assume the character of youth by the direct transfer of blood from the younger to the older individual. Early in the seventeenth century Libavius wrote scornfully of the vaunted virtues of transfusion as a panacea, remarking that "by this means virtue, courage, goodness may be transplanted from one person to another without any disadvantage to the giver." In 1638 the attempt was made to pass the blood from one animal to another, and the practice of introducing medicines directly into the blood was suggested by the great Christopher Wren in 1656. Attempts were made by Clarke, Robert Boyle, Lower, and King in England to transfuse from animals to men, but Denis and Emmerez in Paris first succeeded in actually transfusing lamb's blood into the blood-vessels of a human being on June 15, 1667. The patient was a man suffering from some severe abdominal disease, and he is reported to have been improved by the operation. The procedure fell into disrepute a year or two later after the death of patients in Rome, Paris, and London upon whom transfusions had been performed. During the remainder of the seventeenth century and for the entire eighteenth century no further transfusions were performed on human beings, but experimental work was continued in England, Germany, and Italy in transfusion and infusion. In 1788 Rosa announced the important fact that it was possible to augment the total quantity of an animal's blood without injury to the subject, and Bichat, in 1805, attempted to discover the different effects of arterial and venous blood by means of experiments with transfusion. He succeeded so far that he was able to say that venous blood stimulated the heart to action, while it exerted a depressing influence upon the brain and peripheral nerves.

The publication of Leacock's inaugural essay, in Edinburgh, induced Blundell to renew the efforts in behalf of transfusion in London. To his writings, early in this century, may be attributed the scientific advance of this procedure and its establishment upon a secure basis (*Medico-chirurgical Transactions*, London, vol. ix, 1818, p. 52, and *Researches, Physiological and Pathological, on Transfusion of Blood*, London, 1824). He established several very important facts in connection with transfusion; among them that infused arterial blood contained the same life-giving elements as venous blood; that a much smaller quantity of blood was required to maintain life, after a hæmorrhage, than the actual amount lost; that dogs from which the blood had been withdrawn could live temporarily after an infusion of human blood. He also found that animals which had been starved lived after repeated transfusions, while similar animals which were not subjected to this procedure died. Blundell also perfected a syringe for the performance of the operation. In several cases of post-partum hæmorrhage the patients were saved by transfusion carried out under Dr. Blundell's direction, and the operation gained thereby enormously (*Lancet*, September 17, 1825, p. 342; October 8, 1825, p. 111; November 19, 1825, p. 295).

Prevost and Dumas, about the same time, made a most important discovery in this connection, deriving their information from animal experimentation and removing, at the same time, one of the chief dangers and objections from the operation of transfusion. In the main, their conclusions were that *defibrinated* blood was capable of completely replacing normal blood lost by hæmorrhage and of carrying on the functions of the latter; that the blood of different species was not well suited to the purposes of transfusion, for, although it might maintain a life that was threatened from loss of blood by its stimulant power, the red cells became dissolved in their strange medium and were excreted by the kidneys and the intestines. They further asserted that for human beings human blood only should be employed in transfusion, and that this should always be defibrinated. Among their minor recommendations may be mentioned the caution against a too rapid filling of the blood-vessels, lest the heart's action be impeded, and the fact that defibrinated blood which has been preserved by cold for a considerable time may be used with safety if previously warmed (*Annales de chimie et de physique*, xviii, Paris, 1821). These observations have been confirmed again and again, mainly by Dieffenbach (*Die Transfusion des Blutes*, Berlin, 1828), Bischoff (*Beiträge zu der Lehre von dem Blute und der Transfusion*

desselben, Müller's *Archiv*, 1835, iv), Panum (Virchow's *Archiv*, xxvii, 1863, pp. 240 and 433), and Polli (*Annali universali di medicina*, cited in Schmidt's *Jahrbücher*, lxxv, p. 88).

Following the experiments of Panum (*loc. cit.*), the indirect transfusion of human blood was mainly practised in emergencies calling for this operation. A few years later, however, the direct transfusion of animal blood came into vogue for a short time, but, after unfavourable results in the hands of various surgeons, was relegated to an obscurity from which it has never been recalled. In various noteworthy publications Landois showed, as Prevost and Dumas had previously demonstrated, that the blood of an animal of a different species was not suited to the purposes of transfusion, since a dissolution of the red blood-cells resulted, and that the "resistance" of blood-cells of different species varied widely. He pointed out that the hæmoglobin of the dissolved red cells appeared in the urine in its own form and as albumin within a few hours of the operation. He proved that the transfusion, in large quantities, of the blood of different species frequently produced clots in the larger blood-vessels, which often led to sudden death, and that rouleaux of red cells might fill and occlude the pulmonary capillaries. He finally asserted that blood of a different species was of value only in bringing oxygen to tissues that urgently required it, that such blood could under no circumstances replace the functions of normal blood, and that it mattered little whether this medium was defibrinated or introduced into the circulation of the receiver unchanged. (See mainly *Centralblatt für die medicinische Wissenschaften*, xi, 1873, p. 56; xii, 1874, p. 27; and xiii, 1875, p. 1.) Landois further contends (Eulenburg's *Real-Encyclopädie der gesammten Heilkunde*, xx, Vienna and Leipsic, 1890, p. 43) that the liberated hæmoglobin causes the dissolution of many white blood-cells, by which the fibrin-forming elements of the blood are set free. From these considerations it will easily appear that signs of disturbances in the circulation may make themselves manifest. The skin of human beings who have undergone transfusion with lamb's blood may assume a dark bluish-red colour, followed by circumscribed areas of inflammation and of urticarial eruptions. The occlusion of the smaller pulmonary vessels may determine dyspnœa, a laceration of the capillaries with bloody expectoration, and epistaxis. Sudden death from an embolus may even supervene. Increased peristalsis, with bloody stools and vomiting, and involuntary evacuations, with colic and flatulence, may be some of the symptoms on the part of the intestinal tract. As Ponfick has shown, there may be casts in the urine, or infarcts may appear in the kindey, as Masing has pointed out. The heart, the peripheral nervous system, and the brain may show the effects of a disturbed circulation. In fine, all parts of the organism respond in some measure to the presence of an alien blood. As a rule, after such a transfusion, within a short time (from half an hour to an hour) the temperature rises, sometimes as high as 105° F., but it may subsequently become subnormal owing to the diminished metabolism caused by the circulatory disturbances. The rise of temperature, it should be remarked, may follow the transfusion of allied blood, but it rarely reaches as high a figure under the circumstances above mentioned.

Ponfick and Panum corroborated this valuable work of Landois's, adding some symptoms on the part of the kidneys and liberated hæmoglobin that are significant. The exhaustive labours of these observers succeeded in putting an end to the transfusion of alien blood, convincing even its most ardent supporters. During the discussion concerning the value of transfusion from animals to men other experimenters were labouring with details of the procedure. Thus, Worm-Müller showed that even after a slowly induced but considerable increase in the blood quantity by transfusion—although carried to more than one hundred per cent.—the increase in blood-pressure on the part of the recipient of the blood was very insignificant and produced no disturbance of well-being (*Transfusion und Plethora; eine physiologische Studie*. Univ.-Programm, Christiania, 1875). He also proved that, although the red blood-cells might not live permanently in their new medium, they carried on their functions, for some time at least, and this fact, for the practical purposes of transfusion, is of the highest importance.

It was at this very period that transfusion met with a severe blow, from which it has never fully recovered, in the discovery by Alexander Schmidt that every transfusion with defibrinated blood might contain an element of vital danger by the production of what Köhler calls "ferment-intoxication" (*Arnim Köhler*, Inaug. Dissert., Dorpat, 1877). In order properly to understand the position which Schmidt and his pupils assumed, it will be necessary to refer briefly to the physiology of coagulation. It was Schmidt who called attention to the fact that after the departure of the blood from the blood-vessels its clotting was due to the action of a ferment agent, fibrin ferment, upon the precursors or producers of fibrin—viz., fibrinogen and paraglobulin. He showed, as well, that the fibrin ferment appeared upon the rapid destruction of the white blood-cells which always occurs and which he estimated in the horse to amount to 71·7 per cent. The blood withdrawn from an artery or vein for the purpose of transfusion rapidly produces fibrin ferment, and Schmidt argues that as the fibrin ferment does not entirely exhaust itself by the production of the clot and is in part retained in the serum even after the necessary whipping of the blood, the injection of the serum may be productive of coagulation in the blood-vessels of the receiver; and this is particularly likely to occur if fibrinoplastic material (paraglobulin) is also in solution in the injected serum. Serum containing these elements became known as "ferment blood," and Köhler succeeded experimentally in causing coagulations of the blood-vessels of an animal upon its injection.

The fibrin ferment, however, did not exert its full influence, the interference probably being due to the activity of the erythrocytes.

It is important, however, to note that the theory advanced by Schmidt's school was violently antagonized by those who had succeeded in satisfactorily practising the transfusion of defibrinated blood. Prominent among these was Landois, who pointed out that the fibrin ferment did not exist in blood which had been *thoroughly defibrinated* by sufficient whipping. He admits (Eulenburg's *Real-Encyclopädie der gesammten Heilkunde*, 1890, xx, p. 47) that if one transfuses serum which has been pressed out of clots there is some danger of toxic effect, since this serum is rich in fibrin ferment and richer still in leucocytes, which, upon their introduction into the circulation, are destroyed for the production of new masses of fibrin producers. But Landois insists that with sufficient intelligent care a thorough whipping of the blood withdrawn for transfusion purposes will produce a serum free from fibrin ferment and fibrinoplastic material. He further contends that the body is capable of rendering a small proportion of fibrin ferment harmless, partly by excretion through the kidneys, as other ferments are excreted, in part by the deleterious influence upon it of carbonic acid which is constantly forming in the body as the result of metabolic processes.

The symptoms of the ferment intoxication which did so much to destroy confidence in the practice of transfusion here follow briefly. A considerable quantity of "ferment blood," injected into the jugular vein, may cause the instant death of an animal by asphyxia, and the autopsy discloses extensive clots in the right ventricle, the pulmonary artery, and its branches. The transfusion of a smaller quantity into the peripheral part of an artery may be productive of restlessness, convulsions, pupillary dilatation, severe dyspnœa, rapid and irregular heart action, vomiting, and diarrhœa, in the order named. The animal may recover from this attack or it may remain ill, having fever, severe symptoms on the part of the gastro-intestinal tract, and pulmonary and nervous symptoms, with ultimate death. The mucous and serous surfaces usually disclose hæmorrhagic areas, and ecchymoses of the mesenteric and bronchial glands are not infrequently found. The coagulability of the blood after death is diminished, probably because the fibrin-forming elements have been exhausted. In this connection it is interesting to observe that the transfusion of an alien ferment blood evokes the deepest ferment intoxication. Landois believes that this is because the presence of an alien blood causes a destruction of red blood-cells, the liberated hæmoglobin calling forth not only the production of fibrin ferment, but the destruction of leucocytes as well, which, in its turn, calls into being new fibrin ferment. Von Bergmann agreed in the conclusions reached by Köhler, that, in view of the attendant dangers, transfusion of defibrinated blood should no longer be practised (*Die Schicksale der Transfusion im letzten Decennium*, Berlin, 1883). Despite the protestations of the physiologists, this verdict influenced the practice of transfusion to such an extent that, although it is still done, it has not met with the universal adoption which was expected about twenty years ago. In its place saline infusion has steadily risen in favour in the profession for the emergencies which the transfusion of blood was expected to overcome. Landois (*loc. cit.*) remarks: "It is further asserted that transfusion can never be helpful; it can but be harmful, since the transfused blood is excreted in a very short time, as soon as it has become disintegrated. The blood, it is said, acts only by filling the vessels, and therefore the infusion of a solution containing sodium chloride is to be preferred. And this is urged with such assurance that one might believe that those experimenters who had established beyond a doubt the safety of the transfusion of defibrinated blood had never given the subject their attention; and I refer to those who have proved that the transfused defibrinated blood completely assumes, in the circulation, the functions of the respiratory exchange of gases, of nutrition, and of metabolism, in the same manner as the normal blood, without giving any evidence that its red corpuscles are dissolved or are destroyed any sooner or any more extensively." On the other hand, William Hunter, in his lectures before the College of Surgeons, London, said in 1889: "Any advantages that the transfusion of red corpuscles may have over simple saline injections are counterbalanced by the danger attending the simultaneous injection of white. In the case of defibrinated blood, the latter so predominate that transfusion of defibrinated blood is an operation not only dangerous in itself, but one whose practical value by no means serves to compensate the additional risks run in carrying it out." In the same series of lectures Hunter points out the generally recognised view of those best fitted to judge as to the value of the transfusion of defibrinated blood (*British Medical Journal*, August 10, 1889, p. 308). He concludes that defibrinated blood possesses no nutritive value, that its infusion may possibly be of value if the real need of the body is for red corpuscles; that in simple anæmia, when the absence of iron is the indication to be met, the procedure is valueless; that in a sudden emergency a saline infusion is equally good if not better in its results. In cases calling for either procedure in an emergency, Hunter observes, there is a great fall in blood-pressure which must be met, and the essential thing, therefore, is to fill the blood-vessels. From experimental as well as clinical evidence Hunter concludes that a saline infusion answers the necessary indications without embracing the dangers of the transfusion of defibrinated blood. It is safe to say that in this country and England this is the view of those most competent to judge.

The German experimenters were not able to free themselves from the desire to transfuse blood, either directly or indirectly, after the admitted brilliant researches of Panum, Ponfick, and Landois, already referred to. When they saw the tide turning in favour of saline

infusion—intravenous, intraperitoneal, or intracellular—they devised methods of transfusion of blood which should be free from the objections urged against the older methods, the dangers of capillary thrombosis and of intoxication by fibrin ferment. Von Ziemssen was particularly active in this regard, and as late as 1893 published an opinion that *direct* transfusion was free from the danger of fibrin-ferment intoxication. He invented a method of performing direct transfusion of blood without opening the veins of either giver or receiver, which had the additional advantage, in his opinion, of excluding air during the injection and of allowing of the injection of as great a quantity as was necessary or desirable. A description of the procedure will be given further on. Despite the gallant fight made on behalf of transfusion, it steadily sank in favour, and, although one still reads accounts of occasional successful cases, the injection of saline liquids has almost altogether superseded it. And yet the results of direct transfusion of alien blood were not so serious as one might be led to believe. Many cases were successful, ending in recovery of the patient. This may be explained by the facts that usually a limited quantity was transfused and that, as a rule, the body was able to eliminate the deleterious materials which had entered the circulation. The apparent improvement which at first follows every transfusion of the blood of an animal of different species, even in cases ultimately fatal, may find explanation in the great stimulation imparted by any transfusion to the heart and lungs. Nevertheless, the dangers of capillary thrombosis in the lungs, as well as in the periphery of the body, following direct transfusion of alien blood are real, and this procedure has met a deserved fate in being consigned to oblivion. Every benefit which may be derived from its practice may be obtained from the transfusion of human blood and from a saline infusion.

Before dismissing the subject of the direct and indirect transfusion of human blood it will be well to pass rapidly in review the arguments for and against its practice. Although, as mentioned in detail above, there is no doubt that the red blood-cells live and perform their function in a new medium after a *direct* transfusion, there is equally no question that in the very act of transfusion the danger of clotting in the apparatus and of the clot being carried into the circulation offers weighty objections to this mode of procedure. Further, the fear of subsequent coagulation in the pulmonary or peripheral circulation, against which no caution can be observed, is sufficiently deterrent. The fact, too, that only venous blood, less nutritious and less stimulating than arterial, can be so infused is an argument against the measure. If it were possible to transfuse directly from an artery to an artery through a warmed short tube, the direct transfusion of human blood would offer a greater and wider field than it actually does. At the present day it is rarely if ever practised.

The transfusion of defibrinated human blood is theoretically ideal. Practically, however, the dangers attendant upon its performance render it unsafe. The indirect transfusion of the entire blood as it is withdrawn is, of course, out of the question, for the possibility of clotting after its introduction is even greater than that of directly transfused blood; but even with defibrinated blood the bulk of opinion is against transfusion, for, even though the blood withdrawn may be thoroughly defibrinated, may be actually deprived of fibrin-forming elements, the danger of intoxication from the evolution of new fibrin ferment stands as a bar against its use. It will be remembered, as was pointed out above, that defibrinated blood contains many leucocytes, and that after its introduction into the blood-vessels of the receiver these white cells are disintegrated and form new fibrin ferment. It is true that after many transfusions of defibrinated human blood no symptoms of ferment intoxication have presented themselves. Yet one can never know when this frequently fatal condition may arise, and still the deaths in many lethal cases of indirect transfusion have not been assigned to this cause—cases in which bloody urine and stools, hæmorrhagic exudation into the pleura and peritonæum, and a sudden death from asphyxia have marked the course from the time of the transfusion until the end. Other symptoms described in the discussion on fibrin-ferment intoxication—such as pains in the back and hæmoglobinuria—may be referred to an intoxication or to the destruction of the red as well as of the white blood-cells, evoked, perhaps, by the high temperature following transfusion. Still, many transfusions of defibrinated human blood have met the theoretical possibilities and allow the statement to be made in all truth that under the most careful intelligent supervision a transfusion of human defibrinated blood may be safe. It is possible to account for these instances on two grounds—first, that a small quantity of defibrinated blood was used in the procedure; second, that, owing to the small quantity injected, the red blood-cells of the receiver were enabled to overcome the pernicious effects of the fibrin ferment.

These considerations naturally suggest the cautions to be observed in the event of a transfusion of defibrinated blood being practised. Briefly they are that the blood to be transfused must be *thoroughly defibrinated*. This implies an active beating of the blood for a period of time not less than fifteen or twenty minutes. The blood must not be above the normal temperature of the body, since a transfusion of blood too warm may cause disintegration of the red blood-cells of the receiver, as shown by Landois. The quantity carried into the receiver's blood-vessels at one time must be small and must be allowed to flow at a slow rate in order that the fibrin ferment transfused may be rendered innocuous. A further advantage of allowing the fluid to flow slowly lies in the opportunity provided to stop the operation if at any moment serious or disagreeable phenomena present themselves. A final measure of caution, not for the operation of transfusion but for its omission, is to be ob-

served in those conditions of poisoning and intoxication in which one knows that there is destruction of red blood-cells with an increase of the normal fibrin ferment. Such are, for instance, poisoning by carbonic oxide, ether, chloral, potassium chlorate, and phosphorus. In cases of this nature the danger of transfusion is increased by the almost certain coagulation of the blood in capillary and arterial areas.

To understand properly the purpose of a saline infusion one must consider the cause of death after severe life-threatening hæmorrhage. Goltz believed that the fatal issue was due to the emptiness of the vessels, which impaired the mechanical equilibrium of the circulatory process, and that it was not caused by the actual withdrawal of blood from the body which deprived the vital centres of the physiological stimulus imparted to them by the red blood-cells. With this belief he combined the one that unless the blood-vessels contained a certain quantity of fluid, and unless the blood-pressure retained a certain height, the circulation could not remain unbroken. It may be mentioned in this connection that he proposed the injection of an artificial serum as the best means of filling the depleted vessels. Although Goltz's opinions were violently assailed by many physiologists, the excellent results obtained experimentally and clinically from saline infusions in cases of acute anæmia have led many reliable observers to accept them. The discovery of the fibrin-ferment intoxication gave the procedure of saline infusion an impetus it might not otherwise have received, for immediately upon the establishment of the proof of Schmidt's and Köhler's conclusions the transfusion of defibrinated blood received a sudden quietus. At the same time experimenters were at work upon the merits of different fluids to be used in intravenous infusion as substitutes for defibrinated blood. Maydl, whose experiments convinced him of the futility of injecting a saline liquid, confessed that death was delayed in dogs which had been deprived of two thirds of their blood, estimated by weight (*Wiener medicinische Jahrbücher*, 1884). Kronecker and Landerer (*Berliner klinische Wochenschrift*, 1879, No. 52), on the other hand, rescued dogs which had lost three fourths of their estimated blood by infusions of an equal quantity of neutral saline solution of physiological strength. It was Schwarz, in 1881, who, finding that the injections as made by Kronecker not only were free from danger but actually delayed death and rescued from it, proposed saline infusion as a measure for averting death from hæmorrhage. In the meantime experiments made in the United States tended to show that any indifferent fluid might be used for similar purposes, and fresh cow's milk and goat's milk were proposed as the medium to be infused. This proposition rapidly fell into discredit, since the presence of milk in the vessels is not only dangerous, but serves the purpose for which it is intended in the poorest possible manner, as has been repeatedly proved.

There is, perhaps, in all medical literature no discussion fiercer and more bitter than the one waged at this time between the adherents of the transfusion of defibrinated blood and those of saline infusion. The results of the experiments of each were perverted to suit the individual doctrine; but the latter have won the fight—not, however, until the entire subject had been reviewed anew and modern physiological light thrown upon it. After numerous experiments Kronecker (*Deutsche medicinische Wochenschrift*, 1884, p. 507) concludes that an alkaline solution which he formerly advocated was inferior to a neutral saline solution for purposes of infusion, since the red blood-cells behaved better in contact with a neutral than with an alkaline solution. Landerer concluded (*Archiv für klinische Chirurgie*, xxxiv) that the addition of one part of defibrinated blood to a three- or four-per-cent. alkaline-saline solution was better than either an alkaline-saline solution or defibrinated blood alone. With this solution he succeeded in saving animals which had lost five per cent. of the body weight of blood. He also obtained brilliant results experimentally by adding from three to five per cent. of sugar to the solution. This was done in the belief that the restoration to the blood of the sugar which was lost from it by hæmorrhage was essential. It has been shown since then, however, that this addition is unnecessary, for in the majority of the cases in which infusion is indicated an ordinary solution of sodium chloride answers the purpose.

The term "*physiological salt solution*" requires mention. In the serum of the normal human body sodium chloride is found in the proportion of 0·6 per cent. This has been named the "normal" or "physiological" salt solution. It used to be considered necessary, when employing this solution for intravenous injection, to render it alkaline, because of the known alkalinity of the blood. Thus Hayem proposed for the purpose an artificial serum containing

℞	Sodium hydrate	15½ grains;
	Sodium chloride	80 "
	Sodium sulphate	39 "
	Boiled water	3 fl. oz.

Little proposed a solution composed as follows:

℞	Sodium chloride	50 grains;
	Potassium chloride	2 "
	Water	1 pint.

M.

And a favourite prescription to be found in many text-books of surgery is:

℞	Sodium chloride	93 grains;
	Liquor sodæ	20 drops;
	Water	2 pints.

M.

Many other solutions have been recommended as especially valuable for saline infusions, but clinical experience has taught, as above mentioned, that a solution containing the normal proportion of sodium chloride fulfils every demand.

It must be observed that even the most violent antagonists of saline infusion have

admitted some virtues in it. Landois, for instance, who fought it scornfully and bitterly and who has rendered good service to the cause of transfusion of defibrinated blood, says that the most that a saline infusion can accomplish is to give a patient suffering from a threatening loss of blood improved conditions for the circulation of the remaining blood. He insists that it can not replace transfusion, but concedes that it is valuable as a forerunner of transfusion. In one respect he is correct, when he asserts that in cases of poisoning in which the blood has undergone a change, a saline infusion can not take the place of a depletory transfusion.

Gärtner and Beck (*Wiener klinische Wochenschrift*, 1893, No. 31, p. 563) have shown that after an intravenous injection of a highly concentrated saline infusion absorption from the intestines and serous cavities is perceptibly hastened. And, although their experiments were conducted by oversalting the blood, they added new indications for the practice of intravenous saline infusion: *profuse diarrhœas and cholera*—which had long before been mentioned in this connection, Sir Spencer Wells having had a cholera patient recover, in 1848, after a saline infusion—and the more problematical ones, *acute hydrocephalus and pericarditis*.

Almost all conceivable substances have been injected into the veins of human beings for curative purposes. A few only deserve mention because of their apparent logical use. In the *Lancet* for May 6, 1893, p. 1095, mention is made of a typhoid-fever patient into whose veins *alcohol* was injected while he was in *collapse*. He promptly died. Baccelli (*Wiener medizinische Blätter*, 1894, No. 13, p. 152) describes his method of injecting *mercury* into the veins or subcutaneous tissue in constitutional *syphilis*. His formula is:

℞ Bichloride of mercury..... 45 grains;
Sodium chloride..... 45 "
Distilled water (sterilized) . 32 fl. oz.
M.

Although salivation is sometimes evoked, Baccelli urges the advantages resulting from a small quantity of the drug, the rapid combating of the symptoms, and the prompt action upon the diseased blood-vessels. The intravenous method has not been generally adopted. Hunter (*loc. cit.*), among many others, has announced the futility of injecting by the venous route any substances other than a normal saline solution where a strict indication exists; and it will not be necessary further to emphasize this point.

In considering the indications for the performance of transfusion, both transfusion, direct and indirect, and saline infusion will be treated together, and, unless otherwise specified, infusion will be understood. First and foremost in the list of indications stands *acute anæmia*, as the result of a *hæmorrhage* from traumatism, from surgical interference, or in childbirth. Those who have witnessed the deepened respirations, the gradual filling and increasing strength of a previously almost empty pulse, the colour slowly returning to the face and body after the previous intense pallor—those who have seen these phenomena when a patient seemed to be at the brink of the grave will feel grateful always to those who have persisted in the efficacy of this life-saving measure. Not that it is always successful; for in some instances, unfortunately, it seems to be undertaken too late, or its good effects seem to be lacking. In the writer's cases only fourteen per cent. have recovered; but they were all cases in which the outlook was worse than bad when the operation was begun. But the writer is consoled by the statistics of others, which are in many instances better, in some worse, than his own. Two striking cases are recorded by Sternberger (*Medical Record*, January 7, 1893) in which the high virtue of an intravenous infusion of a normal saline infusion is made plain. Despite the fact that many persons suffering from severe loss of blood do recover after a saline infusion, the experiments of Mayl and of Landois (*loc. cit.*) must not be forgotten. Both these observers maintain that after complete prostration from hæmorrhage, in which the patient passes from one attack of syncope into another, a saline infusion alone can not save life. It is well, therefore, to keep the transfusion of defibrinated blood in mind as a last resort in case the infusion administered does not fulfil the necessities of the case. After the performance of the infusion, preparations may be made for the transfusion, for, after all, the danger of ferment intoxication, which may sometimes be overcome, is not so great or so immediate as the danger to life from the loss of blood. In an acute anæmia the operation must be undertaken as soon as threatening symptoms manifest themselves—general pallor, coldness of the extremities, a small, scarcely perceptible pulse, shallow, sighing respiration, complaint of great thirst, and attacks of syncope. If vomiting is an additional symptom, so that one is persuaded of the impossibility of giving stimulants by the mouth, the operation should no longer be delayed.

Dr. J. H. Glenn (*Transactions of the Royal Academy of Medicine in Ireland*, vol. xiii, 1895, p. 306) reports nine cases of intravenous saline infusion for severe hæmorrhage with two deaths, one in a case already septic. The quantities he infused at the Rotunda Hospital were remarkable, from five to seven pints. His patients bore these large amounts well. When it is considered that an increase in the volume of blood even to 100 per cent. is not injurious to animals, there seems to be no reason why, when necessary, large quantities of a normal saline solution should not be introduced through a vein.

In very obstinate simple *anæmia* without a previous direct loss of blood, and in *chlorosis* of a high grade, transfusion or infusion may be attempted. Von Ziemssen (*Cyclopædia of the Practice of Medicine*, New York, 1876) gives for the former a percentage of 46·9 of recovery after the performance of transfusion. Still, anæmia and chlorosis are usually curable diseases, and the influence of a transfusion or

infusion is but transitory. And it is scarcely wise to advise a measure which has always in it an element of danger for the cure of an affection which usually runs its course to a favourable end. Gusserow recommends a trial of transfusion in cases of *pernicious anæmia*, and Quincke has reported two cases in which he alleged a cure from the use of the measure. Von Ziemssen (*loc. cit.*) urges that in this affection, if benefit is expected, the procedure must be often repeated. It is at best, however, the employment of a last resort, and the danger of ferment intoxication is increased in this and in similar conditions by the abnormal increase of leucocytes. *Scurvy*, *purpura hæmorrhagica*, and *morbus maculosus Werlhofii* must be included in this class of indications for infusion and transfusion. In the last-named disease Jürgensen had unfavourable results, and it is of doubtful value in any of this class of ailments.

The *acute infectious diseases* have been thought to offer a field for the exercise of the benefits of infusion and transfusion. In a case of *typhoid fever* with collapse a successful case of transfusion with lamb's blood has been reported (*North Carolina Medical Journal*, 1890, p. 446). In *small-pox* the results have not been sufficiently striking, either for or against the measure, to warrant a conclusion. In *yellow fever* they have been disappointing. In *cholera* the results may justify the hope that the measure may prove life-saving, although Stromeyer and Little saw little in their trials to encourage them in transfusing; they recommend saline infusion (*Clinical Lectures and Reports of the London Hospital*, vol. iv, 1867–'68, p. 431). Landois, however, has reported three cases of cholera successfully treated with transfusion. A saline infusion, in cholera particularly, seems rational, since it adds fluid to the circulating blood. In *septicæmia* and *pyæmia*, which must be reckoned among the infectious diseases, the results of the measures under consideration have not been encouraging. It does not seem that they are indicated in this class of diseases—except, perhaps, cholera—for the addition of fresh material to the blood, and through this medium to the tissues, can only result in furnishing a culture medium for the bacteria to thrive upon, and will result in the transfused or infused material being disorganized by these organisms. As a consequence, the condition of the patient, instead of being improved, is likely to become worse.

Another indication for saline infusion is found in the *systemic poisoning* of the body by *carbonic oxide*. In this form of poisoning, as is well known, the oxygen of the blood is gradually replaced by carbonic oxide, and death ensues from asphyxia. It was this fact which gave Landois the notion of what he has called "depletory transfusion," in which an artery is opened for the escape of the poisoned blood and normal defibrinated blood is administered by transfusion. He urges the early execution of the process in order that the poison may not too deeply injure the vital centres. The measure has been advocated in poisoning with *carbonic acid*, as in *asphyxia* and in *asphyxia neonatorum*. It can not be said that the results have justified the hopes that were inspired. A saline infusion promises more, particularly as it helps to allay the formation of fibrin. The mitigation of the toxic effects of *chloral*, *chloroform*, *ether*, *phosphorus*, *morphine*, and *opium* has been sought in depletory transfusion as well; but here, too, a saline infusion is apt to prove more helpful, for ether, chloral, phosphorus, and carbonic oxide tend, in poisonous doses, to increase the fibrin ferment in the circulating blood, and Landois himself has brought about clotting in the vessels by the injection of ether. A transfusion has, theoretically, a tendency to enhance the danger in these conditions; a saline infusion is likely to be of real benefit. In poisoning by carbonic oxide (illuminating gas) a saline infusion into the cellular tissue may be rapidly performed and is of great service. The theory of a saline infusion in cases of poisoning rests upon the belief that it may be possible to further the excretion of the toxic substance by increasing the amount of fluid in the blood-vessels. Nocher saved two patients with severe *iodoform poisoning* by a saline infusion of a pint and a half (*Centralblatt für Chirurgie*, 1882, Nos. 14 and 15).

Attempts have been made to cure patients suffering from *cholæmia* and *uræmia* by depletory transfusion, as suggested by Landois. The clinical results have not been encouraging. Von Belina, however, has recorded a successful case of *puerperal eclampsia*. The proposition of Ponfick and von Lesser to carry out transfusion in cases of *severe burns* rests upon the fact that after such accidents the red blood-cells are destroyed in large quantities, inducing hæmoglobinæmia. In these instances, too, clinical proof of the value of the measure is lacking. Hueter, in 1873, recommended peripheral transfusion in cases of *freezing of the extremities*, in order to put into circulation the stagnant blood in the frozen area. The literature of the subject contains no further reference to this proposition, and it is mentioned only for the sake of completeness.

In conditions of extreme *inanition* and *cachexia* transfusion has been advised for the purpose of nutrition, but it does not seem rational to resort to such a violent procedure when better nourishment may be procured by systematic feeding. If such a measure is to be considered, a saline infusion would answer the purpose as well, since it has not been shown that transfused blood is nourishing to the general tissues. A few only of the host of indications that have been urged as legitimate for the practice of transfusion and infusion will be rapidly passed in review. In severe *intestinal hæmorrhage*, as in *typhoid fever* or *after an injury*, infusion is advisable since it is likely to have the same influence as in a hæmorrhage from any other source. The same may be said of *gastric hæmorrhage*, although Leube is not enthusiastic over it, fearing another hæmorrhage because of the rise in blood-pressure; as already pointed out in this article, however, the rise of pressure is nominal, and the fear is,

therefore, ill-founded. In cases of *hæmophilia* infusion is not to be advised, since no stimulant to the heart should be given, and the presence of more fluid in the vessels is apt to induce a fresh hæmorrhage. In *cerebral anæmia* infusion may be done as a last resort. In *chronic gastro-enteritis* in children Demme proposed the injection of defibrinated blood by means of a hypodermic syringe into an unopened vein, when diarrhœa was so profuse as to impair the child's strength. Certainly in this instance a saline infusion is more rigidly indicated. In cases of *severe epistaxis*, in *leucæmia*, for example, an infusion may be deemed necessary. And the same statement holds true for hæmorrhages in any part of the body.

As mentioned above, *acute hydrocephalus*, *acute pericarditis*, and large *collections of fluid* in any of the serous cavities have lately been added as indications for a saline infusion, experiments on animals showing that fluids from serous cavities are more rapidly absorbed after infusion. There is no clinical evidence to substantiate these experiments.

As a final but important indication for saline infusion may he mentioned *shock*. Though the exact nature of this phenomenon has thus far eluded detection, the facts remain that warmth may be renewed in the body, the heart and respirations may be quickened, and life may frequently be maintained by the timely and judicious employment of a saline infusion. The subcutaneous injection of *strychnine* simultaneously will aid the heart in overcoming the difficulties against which it is striving.

According to the manner of carrying out a transfusion, it is recognised by different names. The term *hypodermic transfusion* is self-explanatory. The defibrinated blood is sucked up into a large hypodermic syringe and is injected either directly into a vein or into the subcutaneous tissue. In the latter case it is probable that the red cells become disintegrated and the method is one not to be advised. The injection into a vein, though sometimes difficult of execution, may be carried out repeatedly by leaving the needle in its position. Von Ziemssen (*Arbeiten aus der medicinischen Klinik der König Ludwig Maximilians Universität*, iii, 1893), who has always been an advocate of transfusion, states his belief that a direct transfusion is of advantage if it can be accomplished without the danger of fibrin-ferment intoxication. He suggests, in cases of acute anæmia from any cause, chlorosis, and cachexia, the insertion of a large aspirator needle into the median basilic vein of the giver, and another into the median basilic of the receiver. Under the strictest asepsis, he draws the blood into a slightly warmed glass and injects it into the needle in the vein of the receiver. The syringe used must, after each injection, be washed in salt water, to free it from traces of fibrin ferment. Von Ziemssen maintains, after many trials, that there was absence of hæmoglobinuria and phlebitis, but occasionally he observed chills, fever, and albuminuria. There is also an increase in erythrocytes and in hæmoglobin. The advantages are the opportunity of repeated transfusion and the lack of necessity of incising the vein of either giver or receiver. In 1873 Karst (*Berliner klinische Wochenschrift*, 1873, p. 587) suggested the injection of defibrinated blood into the subcutaneous cellular tissue, with subsequent massage. This was carried out in cases of anæmia of many kinds, in chlorosis, and in cachexia. From six to eight fluid ounces may be injected at a time by means of a large hypodermic syringe, and immediately after the injection massage in all directions is begun and kept up until the mass of blood disappears. No two injections should be made in the same area. As the massage is very painful, chloroform must be administered while it is practised, and the measure is therefore not available in cases of great urgency or emergency. Von Ziemssen found within twenty-four hours after a subcutaneous injection of defibrinated blood an increase in hæmoglobin which gradually diminished.

The injection of an isotonic saline solution into the axillary cellular tissue has been successfully done repeatedly. Mr. Arthur Dodd (*Lancet*, June 27, 1896; *New York Medical Journal*, July 18, 1896) gives a detailed account of the performance of the operation, citing a successful employment of the procedure in a case of partial *placenta prævia*. The results of intracellular infusion into the axilla are similarly striking to those obtained when an infusion is made into other cellular spaces. The instrument used is a slight modification of that employed for intravenous infusion, the only difference being that a sharp-pointed needle of a little stouter make is required instead of the usual blunt one. The needle, tube, and syringe being fitted together, the syringe is filled with the saline solution at a temperature of 100° F. The point of the needle is then forced through the skin of the axilla deeply enough to move freely into the cellular tissue, and the fluid is slowly forced through it. A pint or more may be thus satisfactorily infused.

At a meeting of the Congrès français de médecine interne, M. Vedel presented a report of experimental work with saline injections (*Indépendance médicale*, September 9, 1896; *New York Medical Journal*, September 26, 1896). Experimenting on dogs which he had inoculated intravenously with cultures of the *Bacillus coli communis*, he found that an intravenous saline solution immediately after inoculation produced a slower evolution of the disease and rendered its complications less pronounced. Several successive injections, he says, may be followed by recovery. If the infection is not intense, an early injection may even prevent the development of the infectious symptoms. Slight delay in performing the injection does not give results so favourable, although recovery may still be possible. The consecutive injections are a great aid to the first one. The characteristic hypothermia and cardiac weakness are not benefited by tardy injections, although some amelioration of the pulse may be noted.

M. Vedel had some success with large subcutaneous injections in *cholera*, in *pneumonia of the apex* in an alcoholic subject, and in two

cases of *staphylococcus infection* with disseminated purulent foci. In all of his cases the general effects were about the same. During the injection the pulse grew more energetic, intermittence was suppressed, the blood-pressure and temperature rose, and the respiration was better. These effects lasted for from thirty to forty minutes. Then the critical period set in, reached by a violent chill, frequency and unevenness of the pulse, and accelerated respiration. Convulsions and a rapid rise of temperature followed. At this stage the cold was followed by heat, the face became gaunt, the conjunctivæ were injected, respiration was painful, the pulse was accelerated, and the tendon reflexes were exaggerated. This condition lasted about four hours and was accompanied by diarrhœa, sweating, and urination, after which improvement set in and the patients recovered. M. Vedel asserts that these injections are indicated early in any infectious disease, the indications appearing in the state of the pulse, of the blood-pressure, of diuresis, and of the general condition. Anuria and albuminuria, he says, are no contra-indications to the use of the injections. Large doses, however, are not tolerated well by irremediably affected kidneys; and if pulmonary œdema is present, the injections must be graduated in case of an affection likely to cause hæmorrhages, in order not to favour the tendencies of the infectious disorder.

Similar conclusions are reached by Bosc (*Presse médicale*, June 17, 1896). The critical stage is sooner reached, of course, when the infusion is given by the intravenous route than by the subcutaneous. Bosc thinks the beneficial action of the procedure to lie in the filling of the blood-vessels and in hæmostasis by the contraction of the torn arterioles (when the hæmorrhage springs from this source), and by the precipitation of hæmatoblasts, thus favouring coagulation of the blood. The good results obtained in infectious diseases are of too complex a nature to be as yet thoroughly understood. Several theories have been advanced. It seems scarcely probable that the comparatively small quantity of fluid infused can produce a destruction of the toxines or a sudden increase of resistance on the part of the body, as suggested by Chorrin; it is more likely that the physiological resistance becomes renewed to a more intense activity. It is possible, too, that the profundity of infection may be due to a diminished phagocytosis caused by hypertoxicity of the blood. The dilution of the blood may then bring about a renewed activity of the leucocytes. In the graver infectious conditions—*puerperal septicæmia*, *tetanus*, *pneumonia*, *cholera*, *acute peritonitis*, *septicæmia*, and *pyæmia*—a subcutaneous or intravenous saline infusion may be life-saving in its results.

The diuretic effect of saline infusions has been observed by many writers. F. Dumarest (*Province médicale*, September 19, 1896; *New York Medical Journal*, October 17, 1896) gives the results of his experience with *intramuscular* injections of saline solutions in cases of *albuminuria* and *uræmia*. After the injections, two orders of symptoms were observed. The first was the improvement of the pulse, of the energy of the heart, and of the mental condition and in the disappearance of the so-called toxic symptoms, which revealed an antitoxic influence probably connected with the dilution of the poisons. The later symptoms, polyuria, diarrhœa, and sweating, were more permanent and exercised an eliminating action. The author finds no contra-indication to the employment of these injections in morphological alterations of the kidney. His experience, on the contrary, has been that they exert a favourable influence on symptoms due to these changes. *Anasarca* and *pulmonary œdema* demand their employment, since these conditions are most serious and demand heroic treatment. Combined with phlebotomy, intramuscular injections may turn the tide in the patient's favour. He believes that the saline injections have a double influence; tonic and antitoxic at first, a palliative effect; diuretic and diaphoretic secondarily, a curative influence. The writer sees no reason why intramuscular should be in any way superior to intracellular or intravenous injections, both of which can be accomplished almost as quickly. Moreover, the intracellular spaces unquestionably offer greater areas for absorption than the minute, though numerous, lymph-spaces of the intramuscular tissues; and the intravenous route affords the most rapid opportunity for the infused fluid to enter the circulation. The activity recently shown in this field of research is encouraging. It demonstrates not only the generally accepted value of saline infusions, but an extension of its usefulness which opens up great opportunities for study and for scientific, clinical application.

Rectal transfusion of defibrinated blood was suggested by Dr. A. H. Smith (*New York Medical Journal*, April, 1879) and by Sansom (*Lancet*, February 9, 1881). Ponfick recommended the injection of defibrinated blood into the *peritonæum*, to promote its rapid absorption (*Breslauer ärztliche Zeitschrift*, August 23, 1879). Despite the increase of red blood-cells that was found after this procedure, the attendant dangers of peritonitis, and a death in Mosler's hands, banished the operation. It may be stated in this connection that Afanajew (*Centralblatt für Chirurgie*, 1884, p. 676, citing *Vratch*, 1884, No. 24) suggested the intravenous employment of peptone blood, as it had been shown that this remained fluid for twenty-four hours and the dangers of thrombosis and clotting would be thus avoided. But even the experimental work showed such profound disturbances in the animals used that it was never tried clinically.

The consideration of *intraperitoneal saline infusion* is legitimately in place. The fact that into an unopened abdomen, the visceral and peripheral layers of peritonæum lying in close apposition, the insertion of a needle or of a trocar and cannula is full of danger, renders the operation a hazardous one. It is impossible for even the most skilful operator to determine accurately and beyond peradventure whether the point of his needle lies in the intestine or in the free peritoneal cavity. Moreover, injury to the gut, with a subse-

quent, perhaps fatal, peritonitis—even if the peritoneal sac were, by good fortune, entered—is a very likely and very possible accident. One must therefore unhesitatingly condemn this procedure as reprehensible.

The peritonæum, however, is rapid and reliable in its absorption of fluids. Dr. I. Adler and Dr. S. J. Meltzer have recently shown, beyond any question, that the peritonæum absorbs isotonic and hypotonic solutions of sodium chloride rapidly through the thoracic duct (*Journal of Experimental Medicine*, September, 1896). It does this, moreover, rapidly, and such solutions of sodium chloride thus quickly find their way into the circulating blood. Their further announcement that similar solutions are absorbed from the peritonæum of dead rabbits makes the suggestion about to be made pregnant with significance, for it is in cases in which all the conditions of intra-abdominal pressure are changed that saline infusions of any kind are urgently called for; not, indeed, the changes of death, but those closely allied to it. The suggestion of the writer is that when for any reason an intravenous, or an intracellular or subcutaneous saline infusion, can not be done, or, having been done, seems not to exert the effect expected or desired, a very small incision be made through the *linea alba* into the peritoneal cavity—an incision not over an eighth of an inch in length—and through this opening as large a quantity of normal or isotonic saline infusion as is desired be injected through a blunt cannula or tube. The bleeding would be most insignificant, the shock would be minimal, and there would be a certainty of absorption. The writer is aware of the risks of making even a small incision into the peritonæum, especially when there is a greatly lowered vitality; and he would not minimize the possible dangers of a cœliotomy even to advance a plausible theory. And yet, under the most rigid aseptic and antiseptic preparations and in the face of impending death, he would not hesitate to resort to this procedure if the other usual measures failed him.

There is one other condition in which an intraperitoneal saline infusion may be accomplished. During the progress of a laparotomy, when the indications for a saline infusion arise, the fluid may be placed directly in the abdominal cavity and left there with a certainty of absorption. This measure does not preclude the carrying out of a subsequent rectal or intravenous or intracellular addition to the body's totality of fluids, and may of itself be sufficient to overcome the symptoms arising from a severe *hæmorrhage*. For this purpose the solution should be of the normal strength and at the normal temperature, and the rapidity and infallibility of its absorption allow the employment of a much larger quantity than can be used if the other methods are resorted to.

Transfusion may be *direct* or *indirect*. If *direct* or *immediate*, the blood is transferred from artery to vein, or from vein to vein, or from artery to artery, the choice resting with the operator and according to the circumstances. Most frequently, when done at all, it is accomplished from vein to vein. There are almost innumerable apparatuses for the practice of direct infusion. Among the best are Aveling's and Landois's modification of it, Roussel's, Schliep's, and Albini's. It is unnecessary to describe these in detail, as in many particulars they resemble each other. The essential element of each is a rubber tube of the smallest possible length which, at its middle, is enlarged like the bulb of a Davidson syringe. Two cannulæ are necessary, one each for the vein of the giver and that of the receiver. The latter cannula may be of glass or silver, must be slightly curved, and should be provided with an oblique, well-rounded opening at its distal end—the end that enters the vein. It should be two inches and a half in length and should have a small collar at its proximal end to hold the rubber tubing which is applied over it securely. Further, its diameter gradually diminishes as it approaches the distal end. The giver of the blood must always be a healthy individual, free from acute disease or constitutional taint. After the vein—usually the median cephalic or median basilic in the arm or the great saphenous vein in the leg—is selected, the vessel is dissected free for about an inch and a half. It is then incised and the cannula attached to the rubber tubing is slipped into it. The apparatus has previously been filled with a solution of salt in water. As the blood enters the tubing, the dilatation in the tubing is squeezed while the tubing between the dilatation and the giver is compressed; the tubing between the "syringe" and the receiver is next compressed, the syringe again fills itself with blood, and the act is repeated until a sufficient quantity has been transfused.

If the transfusion is from artery to vein—as the old transfusion of animal's blood was usually performed—it may be done by means of a burette or by the same means as has been described for the transfusion from vein to vein. In the transfusion from artery to artery—usually from the central end of the radial to the peripheral end of the radial—the arteries are incised on the side after that of the giver has been tied peripherally and that of the receiver centrally. The cannulæ are inserted accordingly, after being surrounded by a ligature each, and the blood is allowed to flow, being aided by the apparatus above described. Upon the completion of the operation, both vessels are ligated securely.

The direct transfusion of blood is so full of danger that it is now rarely attempted. The description of the apparatus already given will serve in describing *indirect* or *mediate transfusion*. In this procedure, the desired quantity of blood is drawn from the giver into a bowl, which is placed in another vessel containing water at the temperature of the body. The blood is submitted to a thorough beating, of not less than fifteen or twenty minutes' duration, with a glass rod, the fibrin depositing itself on the staff being removed from time to time. When no more fibrin is observed clinging to the rod, the beaten blood is filtered through linen which has been previously washed, to free

it from the little lumps of fibrin which float in it. In the mean time the vein or artery selected is exposed. The cannula above described is inserted into it, the vein below being ligatured, and about the cannula a loose ligature is applied. A tightly fitting rubber tube is connected with the cannula and the defibrinated blood is allowed to flow in slowly by its own weight through a burette or filter, or is slowly, very slowly, pumped in with a syringe. Upon the completion of the operation, the ligature about the cannula is tightened. When intravenous transfusion is made, the veins mentioned in connection with direct transfusion are usually chosen. Should intra-arterial transfusion be chosen, the radial or the posterior tibial artery may be used. If the transfusion is centripetal, the artery below the point of transfusion is ligatured; if the centrifugal route is preferred—as it is by some, so that the blood may undergo further filtration in the capillaries—the artery must be ligated above the point of the insertion of the cannula. Centripetal arterial transfusion has the advantage of introducing the fresh material directly into the arterial circulation and of more quickly restoring the lowered blood-pressure. In acute anæmia and asphyxia this is of importance. It is sometimes very difficult of accomplishment, as centrifugal transfusion is, because of the great pressure that must be overcome.

It goes without saying that the operation of transfusion, either direct or indirect, must be carried out under the strictest surgical asepsis and antisepsis; and the same caution applies to saline infusion and the other operation herein to be described. The hands of the operator, the skin of the giver and of the receiver, and all instruments employed must be made rigidly aseptic. Further, care must be taken that no air enters the exposed vessels, and, finally, an aseptic dressing must be applied to the wound. The quantity of blood to be transfused varies with the conditions and age. An adult may receive from one to two pints, if given for acute anæmia; if administered in cases of poisoning, a larger quantity may be transfused.

The phenomena usually manifested after a transfusion of defibrinated blood are, in their order, a subjective and objective sensation of warmth, deepened respirations, and a fuller and more frequent pulse. The face and upper part of the body become reddened and the patient perspires. The pulse and respiration gradually become quieter and the flushing and sweating disappear. Sometimes, within a period varying from fifteen to twenty minutes, a severe chill, followed by a rise of temperature, may ensue, accompanied by lumbar pain and hæmaturia. The majority of observers ascribe this fever to fibrin-ferment intoxication. Severe occasional symptoms are bloody exudations into the serous cavities and into the tissues, and sudden deaths from asphyxia have been observed. The hæmoglobinuria has already been accounted for (see above); the lumbar pains have been ascribed to renal infarcts.

A saline infusion requires a less elaborate armamentarium than a transfusion. The cannula above described, a large glass filter or glass jar, and instruments for exposing and ligating the selected vein are all that are needed. A saline solution containing a drachm of ordinary table salt (sodium chloride) to a quart of water is preferred at the present day. The water should be hot when infused, at a temperature of between 116° and 118°, cooled down from 120° F. A vein in the arm, the median cephalic or median basilic, is rapidly exposed by dissection after the application of a bandage tightly rolled about the arm higher up, in order to make the vein stand out distinctly, for it must not be forgotten that in the conditions for the relief of which an infusion is usually undertaken the veins are apt to be collapsed. A small opening is made in the vein with a pair of scissors and the vessel is ligatured below. The cannula is inserted into the opening, a loose ligature is applied about it, the bandage is removed, no longer to obstruct the circulation, and the fluid is allowed to flow from the jar or filter. Care must be taken to avoid the entrance of air, by allowing the saline solution to flow through the rubber tube and cannula before the insertion of the latter into the vein. From one to two pints may be thus infused, the solution flowing slowly from a height of three or four feet. Upon the completion of the operation, the ligature about the cannula is tightened and an aseptic dressing applied. It is not necessary to sew the cutaneous wound.

[Dr. Ely Van De Warker, of Syracuse (*New York Medical Journal*, December 12, 1896), while he grants that subcutaneous infusion and saline rectal enemata are ordinarily quite as efficient as intravenous infusion, insists that they are not so rapid in their action and hence are not to be depended upon in desperate cases. He describes a special apparatus which he has devised. It consists of a glass container large enough to hold from 3 pints to 2 quarts of solution, fitted with a sufficient length of pure gum tubing given off from the bottom of the container. The glass has a scale of ounces etched into its side, so that the quantity of fluid infused at any stage of the operation may be readily ascertained. The second part of the apparatus consists of a cannula, a trocar, and a stopcock. One end of the cock is corrugated so as to be firmly held by the distal end of the tubing. The other end of the cock is slightly tapered so as to slip into the head of the cannula, which is bevelled to correspond, so that when it is connected with the cannula an airtight taper joint is formed. The trocar has a head sufficiently large to be easily grasped by the fingers and withdrawn when the cannula is inserted into the vein. The operation is done by the use of this apparatus as follows: After the vein is exposed a small mouse-tooth forceps is used to pick up the vessel, but any small forceps will serve the purpose. The container having been filled, the stopcock connected with the tubing is held by an assistant. The cannula and trocar together are inserted into the vein, which is held up by the forceps, so as to offer a slight shoulder to the sharp point of the trocar, which is thrust into the lumen of the vein, care being taken not to transfix the vessel. The stopcock is now

opened, and the solution allowed to escape until the tubing is thoroughly warmed and the solution runs out at a proper temperature. The operator is now ready to withdraw the trocar and thus open the cannula, through which the blood flows more or less freely. The stopcock, still open and with the solution flowing, is at once connected with the cannula by the taper joint simply by thrusting the two together. Thus the two currents, one of blood from the cannula and the other of saline solution through the cock, are joined without the possibility of the entrance of air. The flow of solution is regulated by the cock as well as by the height at which the container is held above the point of delivery. In the case of collapsed veins, says Dr. Van De Warker, after a very exhausting hæmorrhage or extreme shock, no blood will escape from the cannula after the trocar is withdrawn.]

Dawbarn (*Medical Record*, January 2, 1892) suggests *intra-arterial* infusion of a sodium-chloride solution of the physiological strength in cases of *collapse* and *acute anæmia*. He infuses into the femoral artery through a hypodermic needle connected to a Davidson syringe by means of a soft-rubber catheter. By combining the hypodermic injection of strychnine, $\frac{1}{15}$ of a grain in divided doses, and the use of a very hot solution, Dawbarn and others have obtained excellent results.

Usually after a hot, intravenous saline infusion there is a chill, quite severe in character, followed by a moderate rise of temperature (to from 102° to 103° F.), which rapidly descends to normal. The chill appears in from fifteen to thirty minutes after the completion of the operation, and may be accounted for, in the writer's opinion, by the cooling down of the blood to a normal temperature after the addition to it of a solution of a temperature of 118° F. Within a few minutes after the infusion the pulse becomes full and strong, the patient perspires freely, and his respirations are amplified. If the case is to proceed satisfactorily, the pulse usually remains full, although not so bounding as at first. If the infusion has not been sufficient to tide the patient over, the improvement is but temporary and a repetition of the operation may be indicated. The flushing of the face observed after transfusion is present, too, after an infusion, and indicates a rise in blood-pressure and an augmentation of the force of the heart's beat.

The employment of a saline solution in the subcutaneous cellular tissue was sure to follow the general disuse of transfusion—subcutaneous and other. Münchmeyer (*Archiv für Gynäkologie*, xxxiv) found it of great benefit in *anæmia* of any kind and in *shock*. As above pointed out, it is a valuable procedure in *acute anæmia* and *poisoning by illuminating gas*. It is of value if the circulation is not too feeble to take up the infused solution; it raises the blood-pressure and thereby increases the force of the cardiac beat. There is no reaction, according to Münchmeyer, and, when done under aseptic conditions and followed by thorough massage, it is a harmless procedure. Münchmeyer recommended a 0·6-per-cent. solution of sodium chloride at 98° F., and the injection of two pints. He found it particularly useful in the *brown atrophy of the heart muscle* common in fibroid disease of the uterus.

Many New York physicians have provided themselves with large sterilized hypodermic needles (such as are commonly used with aspirators), attached to a sterilized rubber tube, which in turn can be connected with a syringe, a filter, or a glass jar—for emergencies in which an intracellular infusion may be called for. The subscapular spaces, the interscapular space, the inguinal region, and the inner side of the thigh offer suitable places for the practice of intracellular infusion.

At the Berlin International Congress in 1891 Lewaschev proposed the replacement of pleuritic fluid by saline solution. In the *Therapeutische Wochenschrift* for June 28, 1896, he calls attention again to this measure. By a thoracentesis he gradually aspirates the pleuritic fluid and replaces it by an equal quantity of physiological salt solution. This prevents a too rapid expansion of the lungs into the empty pleura, while the solution is gradually absorbed. Lewaschev maintains that this procedure exerts a tonic and locally aseptic influence. He reports fifty-two cases of cure by this method.

By "*reciprocal transfusion*," a term proposed by Lauder Brunton, is meant the washing out of leucomaines from the blood-vessels of fever patients with a normal saline solution. A writer, cited in the *New York Medical Journal* for August 17, 1889, suggests the washing out of the blood with the blood of an immunized person, a proceeding the value of which it is not necessary to discuss at the end of this article.

The term "*nervous transfusion*" refers to hypodermic injections of extracts made from the brain or spinal cord.

A compendium of the literature of transfusion and infusion up to 1886 may be found in volume xviii of *Deutsche Chirurgie*, Stuttgart, 1885.—Samuel M. Brickner.

TRAUMATICIN is the name applied to a two-per-cent. solution of gutta-percha in chloroform, introduced by Auspitz, of Vienna, as an improvement upon the solution of gutta-percha which was official at that time in the pharmacopœias. It is used in the same manner as the liquor gutta-perchæ as a protective application to the surface in slight *superficial injuries* or *inflammations*, and is in many respects superior to collodion for this purpose. It may be applied with a small brush, a glass rod, or the finger to *abrasions, slight excoriations, slight superficial wounds* after bleeding has ceased, *fissured lips*, and *cutaneous eruptions*, and by the protection it affords it promotes rapid healing. Its action is purely mechanical. After it has been painted over the affected part the chloroform rapidly evaporates and leaves a thin, almost colourless film of gutta percha which adheres to the skin with sufficient tenacity to furnish protection from the air, friction, or most other sources of

irritation. At the same time it is non-contractile, soft, flexible, and elastic, so that it never mechanically causes irritation in the manner frequently observed after the use of collodion. As this coating is not too easily removed, it may be used as a protection when the healthy skin is about to be exposed to influences which may cause infection, irritation, or abrasion.

In addition to its use as a protective agent in the manner just described, traumaticin has been highly recommended as a solvent and vehicle for various drugs employed in the treatment of skin diseases. Thus, it is maintained that when it is desired to apply chrysarobin in cases of *psoriasis*, it is frequently advantageous to dissolve this drug in traumaticin and paint the solution over the diseased area.

In the treatment of *erysipelas*, Renoy and Bolognesi recommend the application of a mixture of ichthyol and traumaticin, which they state to be abortive in sixty per cent. of the cases. The mixture they employ is composed of three parts of ichthyol and ten parts of traumaticin, a combination which makes a dark-brown liquid. This is applied with a brush over the inflamed area and beyond its border for at least three quarters of an inch.

The employment in cases of *syphilis* of a mixture of calomel and traumaticin has been suggested by Peroni, and very favourable results obtained in this manner are described by Cauchard. A bath is given to the patient and then traumaticin containing twenty-five per cent. of calomel is painted over the skin wherever syphilitic manifestations are present, or, when these are absent, the mixture is painted on the patient's back. This application is made three times a week until the syphilitic symptoms have disappeared. This method of treatment seems to be most efficacious when it is applied to *syphilides* of either the papular, pustular, or squamous variety, as it combines the advantages of both local and general treatment, but it is said to be also of value in cases of syphilis without any cutaneous eruption. Cauchard says that this method is particularly indicated in cases where the internal administration of mercury is not well borne, in children suffering from hereditary syphilis, and in persons with cutaneous eruptions.

This is certainly a very neat and cleanly method of making local applications of such medicaments as those mentioned, and, if further experience demonstrates that such applications are equally effective as those made with the vehicles commonly employed, it should supersede the methods ordinarily in use, as they, in spite of the utmost endeavour, can hardly avoid the charge of being uncleanly.—Matthias Lanckton Foster.

TRAUMATOL, C_7H_7IO, an iodocresol obtained by the action of iodine on cresol, is a purplish-red powder said to be *antiseptic*, non-poisonous, unirritating, and odourless. It has been recommended as a substitute for iodoform.

Ladeire (*Allgemeine Wiener medicinische Zeitung*, September 1 and 8, 1896; *British Medical Journal*, October 17, 1896) records a large number of observations made by himself and others upon the antiseptic and therapeutic properties of this new drug. It appears to have been used with great success in the treatment of *varicose ulcers*, *eczema*, *metritis*, *vaginal gonorrhœa*, *soft chancres*, and *wounds*. Bacteriological researches also prove its antiseptic power. The author states that in contrast to iodoform, which is both irritating and poisonous, traumatol is absolutely harmless and non-irritating, both locally and generally. Internally, its antiseptic action on the respiratory tract is as potent as that of creosote or iodoform. Furthermore, it exerts a most favourable influence on that ordinarily intractable complaint *tuberculous diarrhœa*.

According to Floershein (*Journal des praticiens*, September 26, 1896; *New York Medical Journal*, October 17, 1896), the conditions in which traumatol may be employed are those presenting the general indications for antiseptics. Its preparations are as numerous as those of iodoform and its employment is as simple. It may easily be incorporated in vaseline in the following manner:

℞ Vaseline ..... 75 grains;
Traumatol ..... 15 "
M.

This ointment may be employed in cutaneous affections or in the surgery of the eye. Gauze may be impregnated with traumatol as easily as with salol, iodoform, or boric acid. Traumatol pencils have been successfully used in *fistulous tracts* and in *endometritis;* their preparation is as follows:

℞ Traumatol ..... 150 grains;
Pulverized gum..... 8 "
M.

This is to be mixed with a sufficient quantity of water and glycerin. Traumatol may be mixed also with oil and collodion.

TREACLE, or *molasses*, *theriaca* (Br. Ph.), is sometimes employed in the diet of children on account of its slight *laxative* action, but its chief uses in medicine are as an excipient for pill masses and to flavour the official imitations of chlorodyne. Dr. William Murrell (*Manual of Pharmacology and Therapeutics*, London 1896) gives the following formula for making *treacle whey*, which he says is "regarded by many as a sovereign remedy for a *cold*": Pour two or three tablespoonfuls of treacle into a pint of boiling milk, then let it boil up well and strain it. It is to be taken as hot as it can be borne, after going to bed.

TREFUSIA.—This fanciful name has been given by a Neapolitan pharmacist to a preparation consisting of dried and powdered defibrinated blood. It is termed also a "natural iron albuminate." It is a dark reddish-brown powder soluble in water, said by Geissler and Möller to have the following composition:

Serum, paraglobulin, and globulin..	89·733
Extractives.....	2·475
Inorganic salts.....	6·295
Iron oxide.....	0·382
	98·885

It has been recommended for use in *anæmia* and *chlorosis*.

TRIBROMALDEHYDE.—See BROMAL.

TRIBROMANILINE HYDROBROMIDE.—See BROMAMIDE.

TRIBROMHYDRIN, or more correctly *allyl tribromide*, is a colourless or faintly yellow liquid at ordinary temperatures. When cooled down below 50° F. it solidifies into a mass resembling fat. Its chemical formula is $C_3H_5Br_3$. It is prepared by the action of three parts of bromine upon two parts of allyl iodide. Its specific gravity is from 2·407 to 2·430. The action of allyl tribromide is closely akin to that of the oil of garlic. The oil of garlic contains an organic radicle, *allyl*, C_3H_5. Its exceedingly pungent odour and acrid taste are likewise imparted to the tribromine salt. Both irritate the skin when locally applied, and may even cause vesication.

Allyl tribromide, when given internally, imparts the characteristic alliaceous odour to the urine, the perspiration, and the breath. It has not been extensively used in practice, but, in general, its effects are similar to those of the oil of garlic. It may be employed in spasmodic affections, of organic or functional origin. It has been praised in the treatment of *asthma*, *angina pectoris*, and the *convulsions of infancy*, and is said to relieve the symptoms of *hysteria*. It has probably the action of a mild stimulant upon the gastric mucous membrane. It may be employed, like the oil of garlic, as a *stimulant expectorant* in *chronic bronchitis* and in *unyielding acute bronchitis*.

Allyl tribromide may be administered in capsules in doses of 5 drops. For hypodermic use, it may be given in doses of from 2 to 4 drops, when immediate action is desired, dissolved in a small quantity of ether.

SAMUEL M. BRICKNER.

TRIBROMOMETHANE.—See BROMOFORM.

TRIBROMPHENOL.—See BROMOL.

TRIBROMSALOL.—This compound of bromol and salicylic acid, $C_6H_2.C_7H_2Br_3O_3$, has been recommended as an *intestinal antiseptic*, but has not come sufficiently into use to warrant any definite statement as to its value. It is said to be a very unstable compound.

TRIBULUS LANUGINOSUS. — This zygophyllaceous plant, indigenous to India and Cochin-China, has been credited with being *emollient*, *diuretic*, and *antispasmodic*, and has been employed in the treatment of *dyspnœa*, *colic*, *gonorrhœa*, *spermatorrhœa*, and *urinary irritation*. According to M. Bocquillon-Limousin (*Formulaire de médicaments nouveaux pour 1896*), it has been particularly vaunted in England as a remedy for spermatorrhœa and the mental troubles that may accompany that disorder. A fluid extract, made with equal parts of the fruit and alcohol, may be given in doses of from 5 to 10 drops three times a day.

TRICHLORACETIC ACID.—This compound, $CCl_3.COOH$, is generally considered preferable as a *caustic* to the other chloracetic acids (see CHLORACETIC ACID). As an *astringent* application to *enlarged tonsils* and to the pharynx in cases of *follicular pharyngitis*, Ehrmann (cited by Bocquillon-Limousin) has found it useful when employed in the following solution:

℞	Trichloracetic acid	5 grains;
	Iodine	2 "
	Potassium iodide	2½ "
	Glycerin	1 fl. oz.

M.

TRICHLORPHENOL, a three-atom chlorine substitution derivative of carbolic acid, $C_6H_2<^{Cl_3}_{OH}$, occurs in colourless acicular crystals having the odour of phenol. It has been said to be a very energetic *antiseptic*, far exceeding carbolic acid, but on this point opinions are not unanimous. It has been found highly useful as a topical application in *erysipelas*, in the form of an ointment containing from one to two per cent. of the drug. A solution of the same strength may be employed in erysipelas, also as a wash for *foul ulcers*, and weaker solutions, of from half to one per cent., as a vaginal injection in *leucorrhœa* or for injecting into the rectum in *dysentery*. Trichlorphenol forms a compound with magnesium, *magnesium trichlorphenate*, which has been used in a two-per-cent. solution as a collyrium in cases of *purulent ophthalmia*.

TRICRESOL is a combination of at least three members of the cresol group, which occurs as a colourless oily liquid with an odour resembling that of creosote and soluble in about forty parts of water. Contact with it does not benumb the hands, as in the case of carbolic acid, and it is apparently without effect upon metals. It is about as poisonous as carbolic acid, but, inasmuch as solutions of one third the strength of those of that substance are quite as active, it is held by some to be preferable as an *antiseptic*.

Tricresolamine consists of two parts each of tricresol, ethylenediamine, and water. It is slightly less irritating than tricresol itself, and is employed in solutions varying in strength from one tenth to one per cent.

[Professor Charteris and Dr. John Morton, of Glasgow (*Lancet*, March 31, 1894), have subjected tricresol to experimental investigation, using guinea-pigs for the purpose and injecting subcutaneously 6 minims of the drug mixed with 25 minims of water, also, for the sake of comparison, a solution of carbolic acid of the same strength. They found that this injection of tricresol caused in seven minutes a backward movement, which was shortly followed by convulsions of the hind legs; afterward the whole body was affected. The convulsions were not, however, severe, and in forty minutes they ceased, leaving the guinea-pig a little dull, yet when touched it moved readily.

Pure phenol injections also caused convulsions, which commenced in the same manner and extended over the body. They were, however, somewhat more pronounced than those caused by the tricresol injection; in the course of an hour the guinea-pig recovered.

Neither of the injections was followed by an open sore, but in the course of three days a little hardness was detected at the sites of the punctures in the cellular tissue of the abdomen.

They found that a 12-minim and a 10-minim dose of tricresol caused immediately severe convulsions, which became continuous and involved the whole body. From other experiments they came to the conclusion that a lethal dose of tricresol was from 7 to 8 minims.

Experiments on micro-organisms instituted at the same time showed that tricresol was almost, but not quite, three times as powerful a germicide as pure phenol. An exposure of the *Staphylococcus pyogenes aureus* to a solution of 1 in 20 of phenol invariably rendered the organisms sterile in two minutes, and a solution of 1 in 60 of tricresol had the same effect; but in the shorter exposures the 1-in-20 phenol solution gave a greater proportion of sterile cultures than tricresol.

They therefore conclude that tricresol is three times as strong a germicide as pure phenol, and that it is three times less toxic. Its advantages, consequently, for surgical purposes are very pronounced.

Mr. Robert Lee, of West Kensington, having read Charteris and Morton's article, had the idea of ascertaining if a solution of tricresol would, like one of carbolic acid, when heated, give off a vapour constantly of its own strength. He found that it would, and he consequently suggests its use for *inhalation* in diseased conditions of the respiratory passages in which carbolic acid has been found useful. In his experiments he used a solution of a drachm of tricresol in a pint of water, but he remarks that this is rather strong for children, with whom a weaker one may be employed.]

RUSSELL H. NEVINS.

TRIFOLIUM FIBRINUM, or *Menyanthes trifoliata*, the buck-bean, is a gentianaceous herb widely distributed over temperate regions of Europe and America. The leaves, *folia trifolii fibrini* (Ger. Ph.), are *tonic*, *cathartic*, and in large doses *emetic*. They are now but little used in medicine. The dose of the powdered leaves as a tonic is 20 grains, three times a day; that of the extract, *extractum trifolii fibrini* (Ger. Ph.), is 10 grains.

TRIFORMAL.—See FORMALDEHYDE.

TRIFORMOL.—This is a trade name for *trioxymethylene*, or *paraformaldehyde* (see PARAFORM).

TRIIODOMETACRESOL. — See LOSOPHAN.

TRIKRESOL.—See TRICRESOL.

TRIMETHYLAMINE, or *propylamine*, $(CH_3)_3N$, is a colourless liquid obtained from a large number of albuminoids which have undergone the preparatory stages of decomposition, and is usually employed in the shape of the hydrochloride or chloride. It is an active irritant of the alimentary canal, depresses the action of the heart, and lowers the temperature, especially in *acute rheumatism*, in the treatment of which it has been employed to some extent, from 2 to 3 grains being given every three hours. The dose of the chloride is somewhat larger—5 grains. Applied locally, undiluted, trimethylamine acts as a caustic; given internally in full doses, it is apt to cause temporary albuminuria.—RUSSELL H. NEVINS.

TRIMETHYLETHYLENE.—See PENTAL.

TRINITRIN.—See NITROGLYCERIN.

TRINITROCELLULOSE.—See PHOTOXYLIN.

TRINITROPHENOL.—See PICRIC ACID.

TRIONAL, or *diethylsulphonemethylethylmethane*, is a member of the groups of sulphones to which sulphonal and tetronal belong. Its chemical formula is $C_8H_{18}S_2O_4$, and it differs from sulphonal in containing one atom more of carbon and one fewer of hydrogen. Trional occurs in white, inodorous, almost tasteless crystals. It melts at about 258° F. It is not freely soluble in cold water, more easily so in boiling water, in alcohol, and in milk. It burns on platinum foil without residue.

Administered in doses of from 15 to 30 grains, trional induces a quiet, usually a dreamless sleep, which lasts for from six to eight hours. If it is given at bedtime, this *hypnotic* effect is manifested in from fifteen to forty-five minutes, but sometimes not before an hour. The patient can usually be awakened with ease, but quickly returns to sleep. The action of trional is, as a rule, not cumulative, as that of sulphonal is. It is easily decomposed by the metabolic processes of the body. After the natural awakening at the end of the induced sleep, its effect upon the organism disappears. Its long-continued use is said to have caused the presence of hæmatoporphyrin in the urine; but, although this may appear as a sign of acute or chronic intoxication from the drug, it is doubtful if it appears readily, owing to the easy decomposition of trional in the body.

Occasionally in the morning, after its administration, lassitude and a sense of pressure in the head have been observed, but they have disappeared in a few hours. Very rarely a postponed action of trional is obtained or its effect may be protracted. This is valuable in so far that one dose can thus be made to do service for several successive nights, or one large dose may supplant several smaller ones. It is detrimental, however, in this respect, that the drowsy feeling oppresses the patient during the day. Occasionally, after the ingestion of trional, patients have complained of loss of appetite, belching, and epigastric pain; these symptoms may be accompanied by nausea and vomiting, vertigo, and unsteadiness of gait. In one series of reported cases some of the patients complained of dizziness and inability to stand, and felt as if they were intoxicated. These symptoms soon disappeared and sleep followed. Others have observed tinnitus aurium, great sensitiveness to sounds, and hyperæsthesia.

A reduction in the blood-pressure and a lowering of the pulse from five to ten beats

a minute have been observed, together with palpitation. Animal experimentation shows but little fall in the blood-pressure; at first there is an increase in the number of respirations and heart beats, with death from respiratory paralysis.

The writer has been able to collect six cases of acute and three of chronic intoxication by trional. The symptoms of acute trional poisoning are an intensification of the effects of physiological doses. There appear severe loss of equilibrium, vertigo and ataxia, vomiting, and diarrhœa. The temperature falls below normal. In one case of bronchitis and emphysema in which trional had been given but once there was a great increase in the rapidity of the pulse and respiration, accompanied by great excitation and collapse. Reinicke (*Deutsche medicinische Wochenschrift*, March 28, 1895) describes the case of a young woman suffering from acute hallucinatory insanity to whom trional had been given for fifteen weeks. Her bowels were regular. In one hundred and seven days she received 600 grains of trional in doses of 15 grains every other night. She became affected with headache, vertigo, muscæ volitantes, abdominal pain, and slight elevation of temperature. The pulse became small and rapid, there were nausea and diarrhœa, and the urine contained blood and hyaline and granular casts. Recovery ensued under appropriate treatment, although the general symptoms lasted for some time. Boudeau (cited in the same journal, 1895, No. 45) cautions against the too prolonged employment of trional, since he has observed, after having given it in 60-grain doses in three successive nights, somnolence, hallucinations, stertorous breathing, cyanosis, ataxia, and red discoloration of the urine. Sometimes his patients complained of dizziness, headache, and tinnitus aurium.

Chronic trional intoxication (*Deutsche medicinische Wochenschrift*, 1894, No. 17) is characterized by anorexia, vomiting and constipation, and epigastric pain. Collapse and death may ensue. Hæmatoporphyrin appears in the urine, which is probably due to some disturbance of hæmoglobin.

The hypnotic effect of trional is probably due to a direct influence upon the cerebral cortex. This may be inferred, in the absence of direct experimental evidence, from the occasional cortical symptoms which appear after the ingestion of the drug. Although Dr. Russell Bellamy, of Colorado Springs (*New York Medical Journal*, July 21, 1894), in an "alcoholic service" in Bellevue Hospital, New York, found the drug useful in *delirium tremens*, and although Khmelewsky (cited in the *New York Medical Journal*, April 20, 1895) agrees with him, most observers are not of the same opinion.

[In an article on Insomnia in Surgery, and its Treatment (*New York Medical Journal*, March 2, 1895), Dr. George G. Van Schaick, of the French Hospital, New York, gives a brief account of the case of a woman, thirty-five years old, in which trephining and the removal of a large portion of the frontal bone were required by a depressed fracture of the frontal bone of six years' standing, complicated with extensive necrosis. The patient was an opium-eater, and was also addicted to the use of alcohol in large quantities. The operation, though quite extensive and prolonged, was well borne by the patient, who, however, in a few days became nearly maniacal, insulting the attendants and nurses and being somewhat pugnacious. Morphine had to be given for a few days, but was soon replaced by trional. The operation succeeded very well in relieving an intense headache localized over the forehead. In her case the trional appeared to have replaced the morphine quite satisfactorily, the *opium habit* seemed to disappear, and the patient, who prior to the operation had spent her time either in a state of opium narcosis or in howling with pain and excitement, became very quiet and comfortable. Her mode of life and her inability to obtain proper treatment at home or in an institution, however, led Dr. Van Schaick to believe that she would soon resume the morphine habit.]

Khmelewsky says the use of trional is indicated in cases in which no psychical disorders exist, but cautions against its employment in melancholia and hypochondriasis, because of the depression it may evoke. He has never met with circulatory, digestive, or respiratory disturbances caused by the drug. Other writers, the majority, have not observed satisfactory hypnotic effects from trional in the face of excitement of any kind. When there is pain, trional alone is scarcely to be relied upon, but if combined with morphine, may give good results. It is contra-indicated when there is an annoying cough present and in alcohol, morphine, or cocaine intoxication.

Trional may be given, as a reliable and safe hypnotic, in *insomnia* resulting from *organic brain disease*, or sleeplessness in the different forms of *neurasthenia* and the *functional psychoses*. In *ordinary sleeplessness* from *worry, restlessness, overfatigue*, or *excessive brain work*, it is admirable. It may be administered when sulphonal has failed to induce sleep. Its value as a general hypnotic is high, except in the instances above mentioned. As a *sedative* it is inferior to tetronal.

[Trional has been used to some extent in the treatment of *epilepsy*. Dr. H. P. Boyer (*University Medical Magazine*, March, 1896) reports his observations in regard to this use of the drug by Dr. S. Weir Mitchell, of Philadelphia. In most instances where trional was used the patients were in some way benefited. Either the number of attacks was diminished, their severity lessened, or the general physical condition of the patient improved. The results of its use and the drawbacks are stated in an account of thirteen cases. Some of the patients suffered so much from drowsiness and vertigo, and derived so little benefit in regard to the diminution of the number of attacks, that the treatment was not kept up for more than two or three weeks. Of the thirteen cases referred to, in ten there was a marked decrease in the number of attacks during the treatment, and the physical symptoms also were singularly improved. In five of the cases the number of

attacks was less under the trional treatment than under the bromide treatment: in two others, however, the bromides gave more satisfactory results. Dr. Mitchell believes, says Dr. Boyer, that trional may often prove an efficient substitute for the bromides, and he states that he has seen no ill effects follow its continuous use for many weeks. It is well, he says, at times to give the bromides in the daytime and trional at night.]

Claus (*Internationale klinische Rundschau*, 1894, No. 45; *American Journal of the Medical Sciences*, April, 1895) finds trional an efficient and safe hypnotic for children. He has found it to fail only when pain is present, sleep being induced when the drug was given at bedtime within ten or fifteen minutes. He has found it most reliable in *chorea*, *pavor nocturnus*, and the *insomnia of dentition and indigestion*. No untoward effects were noted, and a habit was not formed.

The advantages of trional over sulphonal are summed up by Vogt (*Nouveaux remèdes*, 1894, No. 21). Sleep is induced more promptly, the sleep is calm and natural, the awakening is normal and free from disorders, and a single dose suffices for the purpose.

The dose of trional for adults is from 15 to 30 grains given at bedtime. It is best administered in hot water or milk, as it is then more rapidly absorbed and a quicker action is obtained. The dose for children varies from 3 to 20 grains, depending upon the age. It may be given as early asin the first month of life.

[According to Claus (*loc. cit.*), the daily amounts of trional that may be given to children of various ages are as follows:

Age.	Dose.
1 month to 1 year.....	3 to 6 grains.
1 to 2 years.....	6 " 12 "
2 " 6 "	12 " 18 "
6 " 10 "	18 " 22 "

A writer in the *Monatsschrift für Geburtshülfe und Gynäkologie* for April, 1896 (*British Medical Journal*, May 16, 1896), gives a summary of recent opinions on new hypnotics and narcotics. In respect to trional, he says, the strength of the dose has been much disputed. The chief importance of this uncertainty, as far as gynæcology is concerned, is the fact that a larger dose is often required during than between the menstrual periods. Bad results have been observed only when very large doses have been given or when the use of the drug has been continued too long. When trional is given for *dysmenorrhœa* or any other painful condition, its use must never be continued for weeks or months, and it must never be given in larger doses than 30 grains.]

If the drug has no effect after two or three successive nights, it is wise to replace it by some other hypnotic. Its use is best interrupted from time to time in order to avoid possible cumulative effects. The constipation which is sometimes seen must be attacked and the extreme acidity of the urine should be provided against by the administration of alkaline drinks.—Samuel M. Brickner.

TRIOXYBENZOL.—See Gallacetophenone.

TRIOXYMETHYLENE. — See Paraform.

TRIPHENINE.—This is a powder, $C_6H_4C_2H_4O.NH(CH_3.CH_2CO)$, homologous with phenacetine. It is insoluble in ordinary menstrua. It has been used as an *antipyretic* and *analgetic* in doses of from 4 to 10 grains, but it has not been tested in practice sufficiently to warrant its being recommended.

TRITICUM (U. S. Ph.) is the rhizome of the *Agropyrum repens*, or couch grass, a plant widely disseminated through the Northern United States. It is a *demulcent diuretic* and is very useful in all conditions, such as *cystitis* or *gonorrhœa*, in which it is desirable to render the urine as little irritating as possible. A decoction of almost any strength may be employed without restriction as to quantity, but the fluid extract, *extractum tritici fluidum* (U. S. Ph.), is a rather more convenient form for its administration. It may be given in doses as large as a fl. oz.

[Triticum must not be confounded with the *farina tritici* of the *British Pharmacopœia*, which is wheaten flour (see Flour).]

Russell H. Nevins.

TROCHES (*trochisci*) are round, oval, or angular tablets or lozenges consisting of sugar, some medicinal ingredient, and some binding material. They are formed while in a moist or plastic condition, and without much pressure. They are sometimes called "pastilles," but in this work the term "pastille" will be restricted to the designation of compounds intended to be burned so as to diffuse a pleasant odour.

The material most suitable as a binding substance for troches is tragacanth, either in powder or in the form of mucilage. All ingredients entering into troches must previously be reduced to the finest possible powder and thoroughly mixed, whereupon the mass is carefully moistened with water or with mucilage of tragacanth if the gum is not already present in the mixture, and worked into a tough plastic mass which will not "run" or flatten out by its own weight. On a small scale the mass is then rolled out either on a pill machine or on a board with adjustable rims, so as to permit of the regulation of the thickness of the troches, and by means of a cutter pieces of the proper shape are then cut out.

On a large scale machinery is employed both for making the mass and for forming it. Machine-made troches are generally preferred to hand-made ones, as they are more uniform and handsome in appearance. Still, as there are some combinations which are only occasionally called for and which the wholesale manufacturer does not care to carry in stock, the preparation of these falls upon the apothecary.

Charles Rice.

TROPACOCAINE.—This alkaloid, $C_8H_{14}NO.(C_6H_5CO)$, called also *benzoylpseudotropeine*, is obtained from the leaves of a Java coca plant. It is employed in the form of the hydrochloride as a *local anæsthetic*, in a solution of the strength of from two to three per cent. According to some writers it acts more

rapidly than cocaine and is less poisonous. Dr. C. A. Veasey, of Philadelphia (*New York Medical Journal*, November 25, 1893), has found that the instillation of a three-per-cent. solution into the eye causes complete anæsthesia in about two minutes, and that this effect lasts for about eight minutes and may be prolonged by repeating the instillations. In his experience the pupil was rarely affected, although in a few cases it was slightly dilated for a short time, and in those cases only was there slight haziness of vision, owing to the range of accommodation being changed a little, the near point being carried farther from the eye. The palpebral fissure was somewhat enlarged, but there was no ptosis. Dr. Veasey considers tropacocaine superior to cocaine in the removal of foreign bodies from the eye, in making strong astringent or caustic applications to the cornea or the conjunctiva, and in cases of *keratitis*, inasmuch as it does not diminish the blood supply to so great an extent. For other purposes he has not found it superior to cocaine hydrochloride. According to Dr. Cerna, large amounts of tropacocaine are apt to produce slowing of the pulse, vertigo, and intense precordial anxiety.

TRYPSIN.—This is the proteolytic ferment of the pancreatic juice. It occurs as a yellowish-white, amorphous powder freely soluble in water and in glycerin, but insoluble in alcohol. It acts upon proteids in a manner similar to that of pepsin. Unlike pepsin, it does not act in an acid medium. The chief products of the action of trypsin are tyrosine and leucine. As a digestive agent it completes the digestion of the proteids already begun in the stomach. For digestive purposes the extract of pancreas, which contains all the digestive agents of the pancreatic juice, is commonly employed. Trypsin has been especially used as a *solvent for diphtheritic membrane* and in certain surgical conditions. In solution, it is unirritating to normal tissue, but has the property of digesting the fibrin of *false membranes* with great rapidity. That it has the power of dissolving diphtheritic membranes to a decided degree can not be doubted. It was at one time very largely employed for this purpose. It is much less used at present, and by most practitioners it has been abandoned for this purpose. It is used as a spray in the following proportions: Trypsin, 15 grains; bicarbonate of sodium, 5 grains; water, 1 ounce. It is sometimes applied to the diphtheritic membrane by insufflation, four parts of trypsin being used to one part of soda. This mixture is sometimes smeared over a dampened brush and painted upon the throat. It has also been used for the purpose of dissolving away necrotic or seriously contused tissues. For this purpose it is prepared as in diphtheria.—Floyd M. Crandall.

TUBERCULIN.—See under *Animal extracts and juices* (vol. i, page 81).

TUBERCULOCIDIN.—This is a modified form of tuberculin prepared by Klebs, said to cause less febrile reaction than Koch's preparation. It has not come into use to any considerable extent.

TUMENOL, or *tumenolum*, or *sulphotumenolic acid*, is a non-official compound, discovered by Spiegel, which is obtained from mineral oil by treating the unsaturated hydrocarbons with concentrated or fuming sulphuric acid. The product is washed free of all excess of the acid and is then crude or commercial tumenol. This is a mixture of sulphones and sulphonic acids which occurs as a dark-brown, acid, syrupy liquid. Tumenol oil consists of the separated sulphones, and occurs as a dark-yellow, thick liquid which is insoluble in water, but readily soluble in ether and in benzene. Tumenolsulphonic acid can also be separated as a dark-coloured powder which has a peculiar, slightly bitter taste and is soluble in water. Aqueous solutions of tumenolsulphonic acid readily take up tumenol oil when the latter is added.

Tumenol was originally obtained from the bitumen found in the Messel mine near Darmstadt, and derives its name from that substance. Very little is known of its therapeutic value in addition to the statements made by a Berlin correspondent in the *Provincial Medical Journal* for January, 1892, which have been reproduced in various places. It appears to have been introduced into medicine by Neisser as a partial substitute for ichthyol, to which it is closely related, but is not so efficient, because it lacks the penetrating, antiparasitic, and sorbefacient properties of that drug.

It is said that compresses soaked in a two- to five-per-cent. solution of tumenolsulphonic acid have been found useful in the treatment of *acute recurrent eczema of the hands and face;* that tumenol oil, in the form of a paste from five to ten per cent. in strength, has proved of value in the treatment of *superficial ulcerations, impetigo*, and *pemphigus;* that an ointment of similar strength of tumenol oil mingled with five per cent. of oxide of zinc and nitrate of bismuth, with lard as a base, has been employed by Neisser in similar conditions with success; and that the *itching of eczema* and *prurigo* may be relieved by the application of a ten-per-cent. tincture diluted with equal parts of ether, alcohol, glycerin, or water. The undiluted tumenol oil is also said to have been painted over the diseased surfaces.

[The sodium salt of tumenolsulphonic acid, a soluble, dark-coloured powder, may be used like tumenol.]

Matthias Lanckton Foster.

TURMERIC, TURMEROL.—See under Curcuma.

TURPENTINE, *terebinthina* (U. S. Ph., Ger. Ph.), is an oleoresin obtained from the trunk of *Pinus palustris* (U. S. Ph.), *Pinus australis* and *Pinus tæda* (Br. Ph.), and from *Pinus pinaster* and *Pinus laricis* (Ger. Ph.). Canada turpentine, Canada balsam, *Terebinthina canadensis* (U. S. Ph., Br. Ph.), is a liquid oleoresin derived from *Abies balsamea*.

Turpentine is a term usually used to describe liquid or concrete juices, derived from certain

trees, which contain a resin and an essential oil, the *oil of turpentine*. Turpentine is generally obtained from species of fir, larch, or pine trees, each species giving its name to the particular turpentine derived from it. The various turpentines are similar to one another in taste and odour. They are at first liquid, gradually becoming solid on exposure.

The most important turpentines are *white turpentine*, *common European turpentine*, *Venice turpentine*, *Canada turpentine*, and *Chian turpentine*. The medical properties of all these varieties depend upon the presence of the oil of turpentine for their virtues. Chian turpentine was at one time thought to have been used with success, locally and internally, in the treatment of *cancer*. Its odour is more agreeable and its taste less offensive and less bitter than those of the other turpentines. It may be given in emulsion in doses of 5 grains, gradually increased as it is well borne by the patient.

Canada turpentine, Canada balsam, or balsam of fir, called in Europe also the *balm of gilead*, is widely used in histological work for the mounting of specimens to be permanently preserved. After it becomes hard, it becomes and remains perfectly clear and homogeneous.

Turpentine Oil.—The oil, or "spirit," of turpentine, *oleum terebinthinæ* (U. S. Ph., Br. Ph., Ger. Ph.), is a volatile oil distilled from turpentine (U. S. Ph.) or from the oleoresin obtained from *Pinus palustris*, *Pinus tæda*, or *Pinus silvestris* (Br. Ph.). It has the formula $C_{10}H_{16}$, is very highly inflammable, and is colourless or faintly yellow. Its specific gravity is 0·86. The odour of turpentine is strong and penetrating, and it possesses a hot, pungent, somewhat bitter taste. Its reaction is neutral or faintly acid. Its boiling point is about 300° F. The oil is slightly soluble in water, a little more so in alcohol, and freely soluble in ether. *Artificial camphor* may be produced by bringing oil of turpentine into contact with hydrochloric acid, when two compounds will be formed, a red liquid and a white crystalline substance resembling camphor. Turpentine has the property of converting the oxygen which it absorbs from atmospheric air into ozone.

Taken internally, in moderate doses, the oil of turpentine gives the sensation of warmth in the stomach. The circulation becomes accelerated and the warmth of the skin is increased, but no cerebral stimulation appears, although vertigo and intoxication may make themselves manifest if the dose is large enough. Frequently repeated small doses stimulate the kidneys, and may, if long continued, irritate the genito-urinary tract, sometimes even causing strangury. The urine obtains a violaceous odour and may contain blood. The drug is excreted by the lungs as well as by the kidneys, and finds its exit from the body through these channels even when it is inhaled. In large doses, turpentine induces catharsis, sometimes preceded by nausea and vomiting. Occasionally an erythematous eruption is observed after its ingestion. Experiments show that the coagulability of the blood is increased by the administration of turpentine. Some cases of death from taking large doses of the oil of turpentine are recorded, but the exact lethal dose is not known. It probably varies with individual idiosyncrasy, but the amount is undoubtedly a large one.

Turpentine is *rubefacient*, inducing in a short time an intense irritation and sometimes inflammation in any tissue with which it comes in contact. This property is taken advantage of in *rheumatic affections* and in some internal and subcutaneous *inflammatory processes*. Its effect upon the skin, however, is so very violent that its local external use can scarcely be commended. In the form of a liniment, it has been found useful by some observers in *burns*, as well as in *erysipelas*, and as a dressing for *local gangrene*. Its topical employment has been recommended in *eczema*, the lesion being changed by its use and thus offering a better opportunity for other therapeutic agents to act. The use of turpentine in *parasitic diseases of the scalp* has also been praised, the statement being made that it destroys the micro-organisms and prevents the development of their spores. The oil of turpentine has extensive employment as a counter-irritant, usually in the form of *stupes*. These may be prepared by dipping pieces of flannel previously soaked in hot water into oil of turpentine which has been warmed by placing the vessel containing it in warm water. The flannel may then be applied to the skin and allowed to remain on as long as it can be borne. Turpentine stupes have been largely used in *bronchitis* and *peritonitis* with good effect, in the latter disease frequently reducing the meteorism.

As an element in enemata, the oil of turpentine often aids to secure an evacuation where other substances fail. After *cœliotomy*, when cathartics are unable to induce a movement of the bowels, or when the colon is filled with hard, impacted fæces, the oil of turpentine mixed with an equal quantity of olive oil will frequently bring about the desired result by its local stimulation to the intestines. Mixed with an equal amount of the milk of asafœtida, and given as an enema, it frees the intestines of flatus in *meteorism from functional causes*. An equally good result may be obtained from the combination of turpentine with ox-gall. In cases of *narcotic poisoning*, the stimulant effect of turpentine may be employed in rectal injections to rouse the system.

The oil of turpentine has been often employed internally in *typhoid fever* when the tongue is dry and fissured and there is decided meteorism. Under its use, the tongue becomes moist and the tympanites diminishes. In the same disease, if a diarrhœa during convalescence is present, indicating a slow healing of the lesion in Peyer's patches, the turpentine seems to foster the healing of the ulcers. In this condition, 10 drops of the oil may be given every two hours. Good effects have also been observed in *ulcerative processes* of the *stomach* and *intestines* from the use of the oil of turpentine, when it probably acts as a stimulant to the diseased areas. The drug has been recommended as being efficient as a stimulant in *low*

fevers and in the local complications of typhoid fever, such as *pneumonia* and *bronchitis*. In the latter disease it may be employed as a counter-irritant and internally at the same time. In *puerperal fever* its local and internal use has been praised. The use of the oil has been extolled in the various *neuralgias*, particularly *sciatica*, and in *lumbago*. Although turpentine is rarely used as a diuretic, its stimulant action upon the kidneys may be taken advantage of in cases of *chronic pyelitis* and *cystitis;* and it is said to act well upon a *chronic urethritis*. Its use is praised in *incontinence* of *urine* depending upon weakness of the vesical walls. Whether it is of advantage in *whooping-cough*, *spermatorrhœa*, *amenorrhœa*, and *impotence* may be doubted.

In cases of *tænia solium* and *ascarides* the internal administration of the oil of turpentine as a *vermifuge* has been much praised. For the same purposes it may be given in the form of an enema with an equal bulk of olive oil. As an anthelminthic, its internal dose is from ½ to 1 fl. oz., given in an equal amount of castor oil or followed after a short time by castor oil.

The inhalation of the vapour of the oil of turpentine was recommended by Skoda in *gangrene* of *the lungs* and is now widely used for this affection and for *fœtid bronchitis* and *asthma*. Baths of the vapour of turpentine are said to be beneficial to persons suffering from *chronic rheumatism;* and the vapour arising from turpentine thrown on the bedclothes is said to cure *scabies*. Baths containing oil of turpentine are said to give good results when the constitutional effects of the drug are sought for. From 5 to 10 fl. oz. of the oil may be added to a bath for this purpose.

The *antiseptic* properties of turpentine are feeble, although the oil does possess some bactericidal properties. The oil of turpentine is an *antidote* to *phosphorus* and in cases of acute poisoning may be given in a mucilaginous mixture in a dose of from 30 to 40 drops.

The dose of the oil of turpentine for ordinary purposes is from 10 to 30 drops, repeated every two or three or four hours as may be demanded. It may be administered on sugar or in an emulsion with glycerin and oil of gaultheria, or with some aromatic water, to disguise its taste. It may be given in capsules or it may form part of a pill made with sugar, oil of lemon, and white wax. The dose of the oil of turpentine as an anthelminthic is ½ fl. oz., taken all at once or in divided doses of from 2 to 4 fl. drachms for two or three doses. In an enema, it may be used, in the combinations above described, in doses of from ½ to 2 fl. oz.

Rectified oil of turpentine, *oleum terebinthinæ rectificatum* (U. S. Ph., Ger. Ph.), is the oil of turpentine distilled in contact with lime-water. It is free from the disagreeable taste and odour of the ordinary oil of turpentine, and the U. S. Ph. directs that it should always be dispensed for internal administration for these reasons. Its effects and its properties are those of the oil of turpentine.

Turpentine liniment, *linimentum terebinthinæ* (U. S. Ph., Br. Ph.), contains 650 parts of resin cerate, and 350 of the oil of turpentine (U. S. Ph.). The Br. Ph. directs that it be made from soft soap, distilled water, camphor, and the oil of turpentine. The liniment of the U. S. Ph. is to be preferred, since it is more stable. This liniment has a deservedly widespread employment in *scalds* and *burns*, having been used in the eighteenth century by factory operatives in England and being later (1797) introduced to the profession by Dr. Kentish, of England. It should be applied as soon as possible after the emergency calling for its use. The best method of application is to saturate cotton or gauze with the liniment and lay them directly upon the burned or scalded areas. Care must be taken to avoid uninjured tissue and to exclude the air. The pain of a burn is quickly relieved by the liniment, and healing of the burned surface is promoted. Dr. Meigs, of Philadelphia, recommended the use of turpentine liniment in *erysipelas* of traumatic origin, and it has been employed with good results in the local treatment of *furuncles* and *carbuncles*.

Liniment of turpentine and acetic acid, *linimentum terebinthinæ aceticum* (Br. Ph.), contains glacial acetic acid, liniment of camphor, and oil of turpentine, in the proportions, respectively, of one, four, and four. It is a rubefacient liniment of great power, and its uses are the same as those of the turpentine liniment.

Confection of turpentine, *confectio terebinthinæ* (Br. Ph.), is made by rubbing together 1 fl. part of oil of turpentine and 1 part of powdered licorice root, and adding 2 parts of clarified honey. Its use is an agreeable method of administering turpentine and has the effects only of the oil. The dose is from 1 to 2 drachms.

The enema of turpentine, *enema terebinthinæ* (Br. Ph.), is an enema containing 1 fl. oz. of the oil of turpentine and 15 fl. oz. of mucilage of starch.

[Turpentine ointment, *unguentum terebinthinæ* (Br. Ph.), is a stimulating ointment containing 8 fl. parts of oil of turpentine, 1 part of resin (rosin), and 4 parts each of yellow wax and prepared lard. The German official preparation of the same name consists of equal parts of turpentine, turpentine oil, and yellow wax.

Turpentine oil is a valuable *hæmostatic*, particularly in cases of *hæmorrhage following the extraction of a tooth*. According to Dr. B. H. Brodnax (*Times and Register*, June 29, 1895), a bit of cotton saturated with it should be pressed into the cavity and kept in place for about five minutes. Dr. N. Mayne, in an article attributed to the *Trained Nurse* (cited in the *New England Medical Monthly* for May, 1896), says that for some years he has used oil of turpentine in *post-partum hæmorrhage*, and in every case with the best results. He saturates a piece of lint with the turpentine, introduces it in his hand into the uterus, and holds it against the walls. Rapid contraction takes place, and all hæmorrhage instantly ceases. In one or two cases, when the patient was almost pulseless, it seemed to act as a stimulant. On no occasion did this action fail, and it did not cause the slightest inconvenience except in one

case in which the side of the patient's thigh was slightly blistered by some of the oil that came in contact with it. He considers it much quicker and surer in its action than any other remedy.

Sasse (*Therapeutische Monatshefte*, February, 1895; *Practitioner*, May, 1895), having observed the immediate hæmostatic action of turpentine oil in the case of a patient who had bled for several hours after the extraction of a tooth, subsequently used it in a case of *scurvy*, painting the gums hourly with the undiluted oil, which was kept in the mouth for a short time, and giving small doses internally. The oral hæmorrhage and the hæmaturia gradually subsided, and the patient's general health improved.]—SAMUEL M. BRICKNER.

TURPETH MINERAL.—See under *Mercury sulphates* (vol. i, page 628).

TUSSILAGO.—*Tussilago Farfara*, colt's-foot, is a synantherous herb indigenous to the northern temperate zone. The leaves, *folia farfaræ* (Ger. Ph.), are *demulcent* and slightly *bitter*. They are used mostly in domestic medicine as a *pectoral*. A decoction made with an ounce of the leaves and a pint of water may be taken in doses of 4 fl. oz. three times a day.

TUSSOL.—This fanciful name has been given to a salt of antipyrine and amygdalic (phenylglycolic) acid. Dr. Rehn, of Frankfort on the Main (*Wiener klinische Wochenschrift*, August 9, 1894), has used the drug in a number of cases of *whooping-cough* in children, and has found it useful in reducing the frequency of the paroxysms and mitigating their intensity. Its action, he says, is different from that of simple antipyrine, and he has observed no untoward effects from its use. It is soluble in water, and as a corrigent raspberry syrup is better than milk. The minimum doses for children are as follows: Under one year of age, from ¾ of a grain to 1½ grain, two or three times a day; from one to two years, 1½ grain, three times a day; from two to four years, from 3¾ grains to 6 grains, three or four times a day; for older children, 7½ grains, four times a day or oftener.

Dr. Rothschild (*Deutsche medicinische Wochenschrift*, January 2, 1896; *Therapeutische Wochenschrift*, March 15, 1896) gives an account of an epidemic of whooping-cough which lasted from October, 1894, until the middle of February, 1895. He treated sixty-one cases, which he divides into three groups. In the first group, consisting of sixteen cases, tussol was not used. The disease lasted from six to ten weeks and was very severe; two of the children, about six months old, died. The eighteen patients of the second group were treated at first with other remedies, and then with tussol. During the first period of their treatment no substantial reduction of the number or the severity of the paroxysms was achieved, but such a reduction occurred after four days' use of tussol. In the twenty-seven patients of the third group the disease was milder; the paroxysms were short, infrequent, and followed by far less weakness than in the two other groups. In very few of these cases only did the tussol seem to have no effect, and they were cases in which it was doubtful if the remedy was given regularly. Rothschild states it as a certainty that in patients who were treated with tussol from the outset, and took their doses regularly, the duration of the disease was notably shortened and its whole course was much milder. In a few of them it lasted not longer than about a fortnight.

TUTTY.—See under ZINC.

TYLOPHORA.—The leaves of *Tylophora asthmatica*, or *East Indian ipecacuanha*, an asclepiadaceous plant of Asia, Africa, and Australia, are used in India as a *diaphoretic* and *expectorant* in doses of 3 or 4 grains, and as an *emetic* in doses of from 20 to 30 grains. Like ipecac, it has been employed with advantage in the treatment of *dysentery*. The leaves are smoked for relief from the paroxysms of *asthma*. Their active principle is an alkaloid, *tylophorine*, the hydrochloride and nitrate of which are soluble in water. These salts have not been used sufficiently to warrant statements as to their dose.

ULEXINE, $C_{11}H_{14}N_2O$, is an alkaloid extracted from the seeds of *Ulex europæus*, or gorse, a European leguminous shrub. Ulexine has been thought to be identical with cytisine (see under CYTISUS LABURNUM), but this is questioned. It has been but little used in medicine, and the statements concerning it to be found in literature are contradictory. For example, a writer in the *Lancet* for February 4, 1888, summarizing the accounts of experimental studies by Bradford (*Journal of Physiology*, viii, 2) and Pinet, says that ulexine seems to have a special action on the respiration, paralyzing the vagus somewhat like curare; on the other hand, Bocquillon-Limousin speaks of it as producing spasms, and yet as being antidotal to strychnine. There is general agreement, however, that it is a *diuretic* of very prompt action, and it is said to have been employed with decided advantage in cases of *cardiac dropsy*. The diuretic dose of the nitrate is from $\frac{1}{20}$ to $\frac{1}{15}$ of a grain.

ULMUS (U. S. Ph.), or slippery-elm bark, the bark of *Ulmus fulva*, is extensively used as a *demulcent* in conditions in which it is proper to render the urine as mild and unirritating as possible, and to a certain extent in *dysentery* and *diarrhœa*, but is of little or no value in these latter states. It also forms the basis of a useful poultice, as it retains its warmth and moisture for a considerable time, more especially when in a powdered state. When it is in this last condition a mucilaginous decoction may be made, which, if sweetened and flavoured with lemon-juice, forms an agreeable demulcent drink, useful to allay the irritation of the throat in *pharyngitis*, etc.

The mucilage, *mucilago ulmi* (U. S. Ph.), is made with about 6 parts of the bark and 100

of water, and is the usual form in which this substance is administered. It is sometimes used externally to allay the irritation of various *inflammatory cutaneous affections.*

RUSSELL H. NEVINS.

ULYPTOL.—See EULYPTOL.

UNGUENTS.—See OINTMENTS.

URAL, $CCl_3.CH{:}OH.NHCO_2.C_2H_5 = C_5H_8O_3NCl_3$, is a drug with reputed *hypnotic* power, made by mixing urethane and chloral. It occurs in white crystals or prisms, and is freely soluble in alcohol and ether, very sparingly soluble in water. Its melting point is 106° F. Burned on platinum foil, it leaves no ash. It volatilizes without decomposition. Boiled with water, it decomposes into chloral and urethane. Ural is bitter in taste. Its effects on the cardiac apparatus and on the blood-pressure seem to be trifling, and but one case of poisoning by the drug is recorded. In general, its influence is said to be similar to that of somnal. Ural has been used chiefly in Italy, and since its introduction, in 1889, it seems to have dropped out of use. Since 1890 there is no record of it in literature. Poppi, who experimented principally with ural, came to the conclusion that its use was indicated principally in the *insomnia of chronic heart disease*, in that of *functional and organic mental disease*, and in *nervous conditions in general.* The drug is probably inferior to trional, and seems to possess little or no sedative action in combination with its hypnotic power.

Administered in doses of from ½ to 1 drachm, it induces sleep in about half an hour. In the case of poisoning recorded it produced symptoms similar to those of chloral depression.

SAMUEL M. BRICKNER.

URALINE, URALIUM, URALUM.—See URAL.

URANIUM.—Professor Kobert, of Dorpat, states that all the soluble and absorbable salts of this metal are violent poisons, more dangerous even than arsenic, half a milligramme of the trioxide to each kilogramme of an animal's weight being surely fatal. Among the earliest symptoms of poisoning is glycosuria; then follow severe gastroenteritis, a nephritis not unlike that of scarlet fever, and hæmorrhages into the heart and the liver; finally, in case death is escaped, there are the gravest disturbances of nutrition and excessive emaciation. Kobert sustains Woroschilsky's statements that uranium must be regarded as poisonous to protoplasm and destructive to every living tissue, even destroying the vitality of the blood. There is no known antagonist to uranium; hence its use as a medicine should be undertaken and carried out with extreme caution, for the symptoms of poisoning are insidious.

In the *Lancet* for June 13, 1874, there was published a brief account of a case of *diabetes mellitus* treated with uranium nitrate. It occurred in Mr. Kennedy's service at the West Ham, Stratford, and South Essex Dispensary, and the notes were furnished by the house surgeon, Mr. R. J. Carey. The patient was a girl, seventeen years old, in whom the disease was well marked. For a fortnight she was treated with tincture of chloride of iron: and then for a little over two weeks more with tincture of opium. She lost ground all this time, and uranium nitrate was then ordered, at first ⅛ of a grain, gradually increased to twice that amount, three times a day. In a week she was decidedly improved, and seems from the report to have been cured a little later. The account closes as follows: "Many may doubt if the nitrate of uranium had anything to do with the patient's recovery, but, as some cases of rapid cure and many of permanent palliation of this disease by the use of this drug have been recorded, it is to be hoped that practitioners of large experience will properly test its value in cases of diabetes mellitus." In spite of occasional allusions to its remedial action in diabetes, however, uranium did not receive much attention until its use as a remedy for diabetes mellitus was revived by Dr. Samuel West, of London, who called to mind the investigations of uranium in its physiological and toxicological relations by Leconte, Chittenden, Lambert, Woroschilsky, and others. In 1895 and again in 1896 Dr. West brought the subject before the British Medical Association. In his first paper (*British Medical Journal*, August 24, 1895) he credits an English homœopathic physician, Dr. Hughes, with having suggested the use of uranium in diabetes on the strength of Leconte's announcement, in 1851, that the prolonged administration of it in small doses caused glycosuria in dogs. Chittenden and Lambert's experiments showed, said Dr. West, that even in small quantities uranium and its salts had an inhibitory influence on amylolytic and proteolytic action, so that a few drops of a one-per-cent. solution of the nitrate prevented the action of ptyalin, and a rather larger quantity that of pepsin and trypsin. The explanation which they gave of this action was that nitrate of uranium formed in combination with albumin a more or less constant and indigestible compound. When administered by the mouth the drug acted slowly, and small doses seemed to be almost as efficacious as large doses. For instance, they obtained the same effect with ⅛ of a grain as with a grain.

Dr. West states that in the uranium treatment of diabetes he at first administered the drug in a routine sort of way to a number of diabetic out-patients, with a view of seeing if any obvious action could be traced. He gave small doses at first and gradually increased them, not knowing how much a patient would be able to stand. He found after the drug had been administered a short time only that all the patients without exception stated that their thirst was greatly relieved, and the frequency of micturition and the quantity of urine passed greatly reduced. This result seemed very promising, and he then instituted a careful investigation by means of daily examinations of the urine of certain patients whom he took into the wards for that purpose. The first patient he had under observation for more than twelve months, and during that time an almost daily examination of the urine was made, and a careful record kept of the

patient's weight, diet, and general condition. The second case had also been under observation for a long time, though not under the close supervision possible with a hospital patient, the lady being a private patient and seen by him from time to time in consultation. In all cases he had tried to place the patient under constant conditions, so that the only difference should be the administration or withholding of the drug.

The first case was that of a man, aged twenty-one years, who had complained of thirst, loss of flesh, and frequent micturition for a period of six weeks. The urine was found to be of high specific gravity (1·036) and to be loaded with sugar. He was taken into the hospital, kept in bed, and dieted. The effect of this change in his habits of life was shown in the increase for the next few days in the amount of sugar and the amount of urine. The diet and general treatment effected a considerable improvement in the patient, so that the percentage of sugar was reduced to six, having been on the man's admission more than eight, and having risen on one occasion to as much as ten. Five pounds in weight had been gained, and the patient appeared and felt very much better.

Uranium nitrate was now administered, at first in small quantities—1 and 2 grains three times a day—but this quantity was gradually increased up to 10 or even 20 grains three times a day, when it was found that it could be tolerated by the stomach without disturbing the digestion.

The first effect noticed was diminution of the amount of urine and of the thirst.

The percentage of sugar, however, did not fall materially until the medicine had been taken for more than fourteen days. It then fell to a mean of four per cent., varying, however, from day to day considerably between three per cent. and five per cent. As the improvement continued, the oscillation became less, and the tendency toward a more or less fixed percentage became marked.

The dose of uranium was gradually increased up to 15 grains, and in six weeks there had been an increase in weight of 5 or 6 pounds. The percentage of sugar fell further, and became more or less constant, about 3·5, and there was a further decrease in the amount of urine, the quantity averaging between 2 and 3 pints daily, and the total daily excretion of sugar, which had been as much as 5 ounces, was now under an ounce. The dose of uranium was now gradually reduced, and about the third week in June the administration was stopped. For a time no change occurred in the patient, but after about ten days the percentage of sugar again rose, and in the course of a week reached to between five and six; the quantity of urine, however, was not materially altered.

On July 18th the administration of uranium was again begun, but this time not in the form of the nitrate, but as a double chloride of quinine and uranium. As the action of this form of the drug was not known, its administration was begun in small doses, and it was not until July 30th that 6 grains had been reached, given three times daily.

The smaller doses seemed to have little effect, but as soon as one of 6 grains three times a day was reached, a sudden drop in the amount of urine and the percentage of sugar took place, the percentage falling to about three and the quantity to about 55 ounces. The dose was now increased to 10 grains, and during the month of August sometimes the nitrate and sometimes the double chloride was administered. In the course of September a still further fall gradually took place in the percentage of sugar, until it reached below one, the amount of urine ranging between 40 and 50 ounces. The amount of uranium given was then reduced gradually to 3 grains three times a day, and its use was continued for some time longer; and during the months of October, November, and December there was hardly more than a trace of sugar present, oftentimes considerably under one per cent.

In the middle of November toast was permitted in the place of gluten bread, the uranium being still given in the same doses. This, however, caused no change in the condition of the urine, and appeared to do the patient no harm, so that he was allowed to have an amount of 6 oz. of toast daily, and this he had till Christmas time. He now had gained about 14 pounds. After Christmas time he was found to be not quite so well. The percentage of sugar was found to be much higher, fluctuating and reaching to nearly six per cent., while the urine was also increased in quantity; the patient had also lost 2 pounds, and looked more ill. Presumably this relapse was due to some error of diet during the Christmas festivities. Ordinary treatment having no obvious effect, and the percentage of sugar still continuing to rise, at the end of a fortnight 5 grains of uranium were given three times a day. This, however, had no effect, and the percentage of sugar still rose, till in the middle of February it once reached as high as nearly ten, though it averaged about eight. The dose of uranium was increased rapidly to 15 grains, but it was not until this amount had been taken for nearly three weeks that its effect was produced, and then—that is to say, about the middle of March—the percentage fell to about four, and the fall continued until at the end of March the urine contained but very minute traces of it, a great deal below one per cent., and this continued to the end of May, the dose of uranium having some time previously been gradually reduced to 5 grains three times a day, which amount the patient continued to take.

At the end of May and during the early part of June the percentage of sugar rose again to between one and two, and finally, when the patient left the hospital, in the middle of June, the percentage was about two, and the daily quantity of urine about 50 ounces. The patient presented none of the symptoms of diabetes, and he did not look ill. He said he felt well and strong, and left the hospital with the intention of going to work. He did not appear again until October, when he said he had

been harvesting, living a good deal in the open air and under rough conditions. He came back because he did not feel so well. He had been for about three months without any of the medicine. From October 12th until the 25th the percentage of sugar was a little more than six. Doses of 5 grains of uranium were given, and subsequently doses of 10 grains. By November 30th the percentage of sugar had fallen to a little below four. At Christmas time, probably again in consequence of the festivities of the season, the percentage was as high as eight. Doses of 15 grains of uranium were then given and the percentage of sugar fell rapidly, so that by the end of January it was constantly under two. During the whole time the patient had been regulating his diet so far as he was able to do so.

The second case was that of a married woman, forty-five years old, who had been in robust health until about six months before Dr. West saw her, at which time she began to suffer with irritation of the pudenda, frequency of micturition, thirst, and loss of flesh. Examination of the urine showed that she was diabetic. She was placed upon a fixed diet and treated with various drugs. She weighed at the beginning of her illness 129 pounds. The previous treatment had caused considerable improvement in her general health, and the loss of weight had not continued. Before the uranium was used, analyses of the urine were made, and the quantity averaged about 1,625 cubic centimetres, the specific gravity 1·034, and the percentage of sugar about 2·4. At the end of November the use of uranium nitrate was begun in small doses. One grain was given at first twice daily, and then, a little later, three times a day. The results began to be manifest in the beginning of December, first upon the quantity of urine, which fell considerably, and as the dose was increased the percentage of sugar fell also. In three weeks from the beginning of the treatment the percentage began to fall, and with each increase in the medicine the percentage decreased, until after she had been taking 2 grains three times a day for a week or ten days the percentage was under one. Then 3½ grains were given three times a day, and the percentage fell one half. Four grains were then given, and on January 22d the sugar disappeared entirely from the urine. At this time the average amount of urine was 1,300 cubic centimetres, and the specific gravity 1·018. From this date, says Dr. West, sugar was entirely absent from the urine, except on four odd days, until the end of April. The highest amount of sugar present on these odd days was 0·37 per cent. During May, June, and July traces were present, although in most of the examinations no sugar was found at all; but even when a small amount was found it was usually less than 0·5 per cent., and the highest record was only 0·7 per cent. During all this time 3½ grains of uranium nitrate were given three times a day. In September, although she was still taking the uranium, the percentage of sugar rose, the quantity of urine was also increased and averaged about 1,500 cubic centimetres, and the specific gravity was about 1·020. At the same time considerable fluctuations were noticed in the quantity of urine, in the specific gravity, and in the percentage of sugar. This relapse, says Dr. West, was due to experiments in diet and also to the consequence of worry in regard to household affairs. If he had seen her at that time, he says, he would have increased the dose of uranium nitrate.

The chief point of difference between this case and the preceding one, says Dr. West, is that small doses of uranium, not exceeding 4 grains, had a marked effect, though in the first case much larger doses were given, and appeared to be necessary. Still, it is quite possible, he thinks, that when the effect is once produced it can be maintained by small doses, and he is inclined to think that, though the drug takes longer to act when given in small quantities, its effect does not depend entirely upon the amount administered each day, but that in some respects, though taking longer to act, the small doses may have almost as efficient an action as the larger ones.

Professor Chittenden observed that the prolonged administration of uranium was followed by the presence of albumin in the urine, consequent upon an irritant and destructive action on the renal epithelium, but albumin did not appear at any time in the urine in either of Dr. West's cases, and he says he has never observed it in the other cases he has treated with uranium. Possibly this may be due, he says, to the gradual administration of the drug, and what he has observed would be quite in accord with Professor Chittenden's further statements that if the albuminuria produced by a certain dose was allowed to disappear by suspension of the drug, the drug could then be given again, and the doses increased even to ten times the original amount before albumin again appeared. This, says Dr. West, would appear to point to the necessity of giving the drug in small amounts at first and increasing them gradually.

These cases, taken with others, says Dr. West, all point to the conclusion that we have in uranium nitrate a drug which has a powerful effect upon diabetes. In the first and second cases the amount of sugar was greatly influenced by diet, and it is quite possible, he says, that this drug may be found most useful in this class of cases on account of its physiological action upon digestion. That the effect is clearly due to the drug is shown by the fact that when dieting and ordinary treatment have produced all the improvement that is possible, still further improvement takes place after the administration of the drug. As to its mode of action, he says, we can do nothing but speculate. He thinks it likely that its action is due to the effect it has in checking the rapid digestion of starch and of some forms of albumin, and that it may perhaps be especially useful by controlling excessive pancreatic digestion.

As to the size of the dose, he has given 10, 15, and 20 grains three times a day without gastro-intestinal irritation being produced.

Something depends, he suggests, upon idiosyncrasy. At the same time he thinks it possible that when the patient has once come under the influence of the drug a reduced dose may be sufficient to keep up its action. In the second case the patient attributed her loss of flesh to the action of the drug. This, says Dr. West, is doubtful, and certainly the first patient continued to gain in weight while taking much larger doses.

As regards the salts of uranium, he has used only two—the nitrate and the double chloride of uranium and quinine. So far as he can see, there is no difference in the action of these two salts; still, he suggests that the uranous salts, instead of the uranic which he has been using, may have a different effect. The nitrate, he thinks, is best given freely diluted with water and after food, beginning with a small dose of 1 or 2 grains twice daily after the chief meals, and increasing the quantity slowly at intervals of a few days until its effect is produced. So given, he has not found it disturb digestion or cause any irritation of the stomach or bowels, and he has never found its prolonged administration produce albuminuria.

In his second communication (*British Medical Journal*, September 19, 1896; *Therapeutic Gazette*, September, 1896) Dr. West reported that further experience had confirmed the general statements that he had made the year before, and he gave brief accounts of five more cases. The first one was an instance of acute diabetes in a woman of twenty-two years. On her admission she was passing 10 pints of urine containing eight per cent. of sugar. After she had been dieted for three weeks in the hospital the amount of urine was reduced to 4 pints and the percentage of sugar from eight to six: but during all this time there were great fluctuations in the amount of urine and in the percentage of sugar, such as were usually seen in bad cases of diabetes. After she had been placed upon the use of uranium nitrate, the doses being gradually increased to 5 grains three times a day, the percentage of sugar had been reduced to four, the patient had greatly improved and gained 10 pounds in weight, and the irregular fluctuations referred to had entirely disappeared. On her leaving the hospital a short time afterward the percentage had been three and a half and the quantity of urine 3¼ pints. She had gone home to the anxieties and work involved in the care of a family of small children, had been unable to continue the dieting, and had, he believed, died not long after.

In the second case, that of a woman of forty-four, the patient had been passing 7 pints of urine containing seven per cent. of sugar, with considerable fluctuations between a maximum of 9·3 per cent. and a minimum of 6·5. After her being dieted in the usual way, the percentage had fallen to 6·8, and then uranium nitrate had been given, with the result that the percentage fell to 4·6. She had greatly improved in the hospital, and had continued to take the drug some time after she left.

The third case was that of a young man, aged twenty-five, with acute diabetes of short duration. He was passing, on admission, 7 pints of urine, with a percentage of between six and seven of sugar. Ordinary diet produced but little effect upon the quantity of urine and not much upon the percentage of sugar. Under the influence of the drug the percentage fell from six to between three and four. Ten grains of the drug were taken three times a day without any inconvenience, the appetite remaining good and the weight increasing. Toward the end of his time he was allowed to have from 4 to 6 ounces of bread or toast. The use of the drug was continued, but under this diet the percentage rose only to four and a half—not so much as might have been expected. He had been taking the drug now for a long time as an out-patient, was considerably heavier than when he was in the hospital, and was able to do his work well; and although under irregular conditions of diet the percentage of sugar was heavier, still he believed the drug was a necessity to him, and he was much better and abler for his work while taking it.

The fourth case was that of a man aged fifty—a bad case of only six months' duration. The daily amount of urine was about 5 pints, with six per cent. of sugar. He was dieted as strictly as possible, but could not be got to do without bread. The dose of uranium was increased up to 10 grains three times a day, which he took without any inconvenience, and he gained several pounds in weight. Under the combined action of the drug and diet the quantity of urine was reduced about a pint, the specific gravity remaining much the same, and the percentage of sugar fell somewhat. The most marked feature about this case was that the irregular fluctuations, which had been so marked soon after the man's admission into the hospital, entirely disappeared, and the quantity of urine and sugar became fairly constant.

The last case was that of a private patient, aged forty-one, who had been the subject of diabetes for about four years. In this case the drug had not proved efficient. The patient had never been able to take more than about 3 grains three times a day, and while he was taking the drug the lowest percentage of sugar reached was 2·3. As long as he was under observation the percentage averaged about three before he began to take the drug. Before he came under observation the analyses had been made very irregularly, but it was stated that the percentage had on occasions been lower than this and that on some days sugar had been entirely absent. These statements, however, Dr. West could not vouch for. The drug, in the doses given, seem really to have little or no effect, and, as the indigestion became somewhat disturbed, its use ultimately had to be suspended. The failure of the drug in this case might be attributed, he thought, in some degree to the idiosyncrasy of the patient, who was unable to take any but very small doses, and even those for only a brief period.

Dr. West's general conclusions were the same as those he had expressed the year before, viz.: that we had in uranium nitrate a

drug of considerable value in the treatment of diabetes mellitus, though, like all other drugs, it could not be relied upon to produce equally good results in all cases indiscriminately.

In spite of the fact that Dr. West's patients suffered no harm from the doses that he thought requisite, it does not seem safe, as a rule, to begin with more than $\frac{1}{6}$ of a grain, to be given three times a day.

URETHANE, or *ethylurethane*, or *ethyl carbamate*, $CO(NH_2)OC_2H_5$, is a synthetical product which is formed by the interaction of ammonia and ethyl carbonate or by that of nitrate of urea and ethyl alcohol at from 120° to 130° C. It is alleged by Rademaker to be a constituent of albuminous urine, from which it can be extracted, though never present in normal urine, and it has been suggested by him that the presence of this substance may occasion certain of the symptoms which are present in uræmic poisoning. It occurs in colourless tabular or columnar crystals, which are odourless or have a slight ethereal odour and a taste which resembles that of nitrate of potassium. It readily forms solutions, which are neutral in reaction, with water, alcohol, and many other media. It melts at from 47° to 50° C., and boils almost without decomposition between 170° and 180° C., giving off vapours which burn with a blue flame. When an aqueous solution of urethane is treated with nitric or oxalic acid or with nitrate of mercury, if a white precipitate is formed, urea is detected to be present.

Experimental investigations on the lower animals show that urethane produces a short period of excitement and stimulation of the respiratory and cardiac action, which is followed by profound sleep during which the respiration again becomes slower. A fatal dose causes the respiration to become slower, the temperature lowered, motion, and subsequently sensation, to be lost, the reflexes to be abolished, the unconsciousness to become absolute, and the heart's action to grow feeble. Death occurs from asphyxia. In small animals it is said to be an effectual antagonist to the action of strychnine. It has no analgetic power. A careful consideration of the results of these experiments does not yield a thoroughly satisfactory explanation of the physiological action of urethane. It would seem to act directly upon the cerebrum and spinal cord, and possibly upon the entire nervous system. Van Amrep demonstrated that large doses of the drug occasioned a loss of the faradaic sensibility in the cerebral cortex. The lessening of the reflex action appears to be primarily due to its influence on the spinal cord, and it seems to be probable that the excitability of the motor and sensory nerves is reduced.

Urethane was introduced into medicine as a *hypnotic* in 1885 by von Jaksch. It is quite mild in its action, and seems to be devoid of the dangerously poisonous qualities which characterize the more powerful hypnotics. The very small amount which has recently appeared in literature regarding this drug may perhaps indicate that the conclusion of Dr. Griffith and Dr. Kirby, that it is unreliable and uncertain in its action, has been accepted by the profession and its use to a great extent abandoned, but some observers commend it very highly as a *sedative* and *hypnotic*, not only in cases of *insomnia* from slight causes, but also in *functional disturbances and organic diseases of the brain*. It is not sufficiently powerful to take the place of sulphonal, paraldehyde, or chloral in *delirium tremens* or *acute mania*, but when the depressant effect of the stronger hypnotics is contra-indicated from any cause, and the insomnia does not depend on such grave conditions, urethane is particularly useful. Demme recommends it as of special value in children, and reports a number of cases thus treated. He gives 4 grains to a child a year old, and believes that larger doses are safe even when the children are weakly, as he has never seen any unpleasant effects from its action.

Cases of the successful treatment of *tetanus* with urethane are recorded. Abbott has reported a patient as cured in two days by the ingestion of 9 grains every two hours and 30 grains at night.

It is advisable to give urethane in several small doses, frequently repeated, because a single large dose is apt to induce vomiting. In this manner from 10 to 60 grains may be administered. As it has no irritant action, it can be given hypodermically in doses of from 4 grains upward.

MATTHIAS LANCKTON FOSTER.

URICEDIN.—This is a German proprietary preparation, a white, granular substance freely soluble in water, of a slightly acid reaction, said to consist of 67 per cent. of sodium citrate, 27·5 per cent. of sodium sulphate, 1·6 per cent. of sodium chloride, and 1·9 per cent. of lithium citrate. It is used in the treatment of *gout* and the *uric-acid diathesis*, in daily amounts of from 15 to 30 grains. Large doses, from 3 to 5 drachms, may cause diarrhœa.

UROPHERINE. — This is lithio-theobromine salicylate, $C_7H_7N_4O_2Li + C_6H_4(OH)COOLi$, being an analogue of diuretin, which is sodio-theobromine salicylate (*q. v.*). It is a white powder soluble in water. It is used as a *diuretic* in doses of fifteen grains.

UROTROPINE.—Dr. Arthur Nicolaier, of Göttingen, has given this name to hexamethylenetetramine, a compound formed by the action of formaldehyde on ammonia, because he has observed various changes in the urine under its use. In the *Deutsche medicinische Wochenschrift* for August 22, 1895 (*New York Medical Journal*, October 19, 1895), there is an article by him on the therapeutical use of urotropine. He says that under the influence of the remedy diuresis is increased; that uric acid and sedimentary urates, previously present in large quantities, no longer appear; and that the disappearance of these deposits is not a mere consequence of the increased diuresis, but is due to the direct action of the remedy on the uric acid and its salts. These experi-

mental results, he thinks, have demonstrated that urotropine may be employed not only as a *diuretic*, but in the treatment of the *uric-acid diathesis* and the various morbid conditions dependent upon it.

His further experiments show that the remedy is especially adapted to the treatment of *uric-acid calculi*, for after the ingestion of urotropine the urine, without any change occurring in its acid reaction, gains certain properties that make it a uric-acid solvent. Thus, if an adult whose urine does not dissolve uric-acid concretions even after several days' retention in the culture oven is given sufficiently large doses of the drug, it is found that within twenty-four hours the urine begins to dissolve such calculi placed in it, and kept at a temperature of 98·6° F., and that this goes on until after several days only the organic albuminous framework of the stone is left. The urine loses its uric-acid solvent properties as soon as the urotropine is all excreted.

Further researches have shown that the increased diuresis may be absent in certain cases, also that, while doses of 120 and even 150 grains may be borne by adults, yet in certain cases, for some unknown reason, the continued use for lengthy periods of time of daily doses amounting to only 90 grains occasionally causes unpleasant symptoms which call for a decrease in the size of the dose. Several patients that had taken urotropine in large doses for a time began to complain of a sensation of burning in the vesical region, generally after urinating; these pains radiated along the urethra, and were sometimes accompanied with an increased desire to micturate. The urinary examination in these cases showed only a moderate amount of transitional epithelium and no other abnormal constituents. If in spite of these symptoms the use of the remedy was persisted in in the same doses, the trouble increased in severity, and occasionally red blood-corpuscles appeared in the sediment. All these troubles disappeared, however, as soon as the dose of urotropine was diminished or its use was discontinued entirely, and the urine soon returned to its normal state. From daily doses of less than 30 grains the author has never seen any ill effects, no matter how long their use was continued. Occasionally, however, he has found small quantities of transitional epithelium in the sediment even then. He therefore now limits the doses to from 15 to 22 grains daily, that amount being taken at once, in the morning, dissolved in water.

Nicolaier noticed that the urine of patients that were taking from 45 to 90 grains of urotropine remained clear and retained its acid reaction at a temperature of 98·6° F., even when a few drops of urine in a state of ammoniacal fermentation were added to it. Several specimens of such urine he has kept for months in the oven, without ammoniacal decomposition setting in. Even after inoculation with pure cultures of the *Bacterium coli commune* such urine remained sterile at 98·6° F. The same thing happened with the urine of persons who were taking daily doses of 15 or even 7½ grains. These observations have convinced him that the use of urotropine hinders the development of micro-organisms, such as the bacteria of the *ammoniacal decomposition of urine* and the *Bacterium coli commune*, which latter, he remarks, is a factor in many of the bacterial diseases of the urinary passages. The results of his experiments in this direction show, in his opinion, that the drug ought to be employed in these morbid conditions. He has used urotropine in two cases of *cystitis* in which the urine was strongly ammoniacal, and found it quickly efficacious. In cases in which the urine was acid he has not found it effective.

Dr. J. A. Flexner (*American Practitioner and News*, December 28, 1895) says that alkaline and putrid urine containing mucus in excess, pus and pus organisms, uric acid, or amorphous urates, are rapidly restored by it to a normal appearance and an acid reaction. The urine is sterilized and increased in quantity, and calculi and deposits are dissolved. He concludes that urotropine is a most valuable resource in *suppurations of the urinary tract* and in *gouty* and *rheumatic conditions* where an active eliminant of uric acid and its salts is indicated. A further valuable property of urotropine, he thinks, is its faculty of combining readily with salicylic acid and forming a soluble combination. A solution containing from 10 to 15 grains each of urotropine and salicylic acid to the fluid ounce of water or other suitable vehicle has the further advantage over the salicylates alone that its taste is not disagreeable. It appears, he adds, to be far less irritant to the gastric mucous membrane than solutions of salicylic acid usually are, and he thinks the combination promises to have a wide range of therapeutic usefulness.

URTICA.—The common stinging nettle, *Urtica dioica*, has been recommended as a *diuretic* and *hæmostatic*, especially for checking *uterine hæmorrhage*. A decoction made in the proportion of 1 part of the herb to 16 parts of water may be given in doses of 4 fl. oz. three times a day. There is a non-official fluid extract the dose of which is ½ fl. drachm.

Urtica (or *Pilea*) *pumila*, the bastard nettle, has been found efficacious in the treatment of *rhus poisoning* (see vol. ii, page 132).

USTILAGO MAIDIS.—See *Ergot of maize* (vol. i, page 389).

UVÆ.—Grapes. See GRAPE CURE.

UVA URSI (U. S. Ph.), *uvæ ursi folia* (Br. Ph.), *folia uvæ ursi* (Ger. Ph.).—The leaves of *Arctostaphylos uva ursi*, or bearberry, a shrub widely distributed throughout the higher parts of the temperate zones, are *astringent* and *diuretic*, resembling buchu in their action, although inferior to it. It is also somewhat *tonic* and is indicated in *chronic cystitis, gleet*, the later stages of *diarrhœa*, and *pyelitis*, but is hardly active enough to take the place of other diuretics when there is ascites. Its properties are believed to be due to a crystalline body, arbutin, which may be substituted for the leaves in doses of from 5 to 10 grains. The leaves themselves may be given in doses of from 50 to 60 grains. The dose of the infusion, *in-*

fusum uvæ ursi (Br. Ph.), is from 1 to 2 fl. oz. An unofficial decoction made in the proportion of 1 part of the leaves to 16 parts of water may be employed in doses as large as 2 fl. oz. The extract, *extractum uvæ ursi* (U. S. Ph.), and the fluid extract, *extractum uvæ ursi fluidum* (U. S. Ph.), may be given respectively in doses of from 20 to 60 grains and from 30 to 60 minims.—RUSSELL H. NEVINS.

VACCINIUM.—Several species of this typical genus of the *Vacciniaceæ* have been used in medicine. The berries of *Vaccinium Arctostaphylos*, or Oriental whortleberry, *Vaccinium corymbosum* (or *discomorphum*), or the common blueberry, *Vaccinium frondosum*, or the American blue whortleberry, and *Vaccinium Myrtillus* (or *nigrum*), or the English whortleberry, were formerly used as a mild *astringent* in *diarrhœa* and *inflammatory affections of the throat*, also as a *hæmostatic*. Winternitz (cited by Hare, *Medical Annual*, 1893) has found those of *Vaccinium Myrtillus* efficient in the treatment of *leucoplakia buccalis*, as well as in various other affections of the mouth, chiefly in the form of a concentrated decoction.

The berries of *Vaccinium Oxycoccus*, or the cranberry, have been employed as an *astringent*, *detersive*, *antiscorbutic*, and *refrigerant*.

The leaves of *Vaccinium Vitis idæa*, the red whortleberry or red bilberry, have long been used by the Russian peasants, who call the plant *brousinka*, as a remedy for *rheumatism*. Dr. T. T. Hermann (*British Medical Journal*, April 19, 1892) has used it in the form of a decoction or infusion of 1 part of the fresh herb, with the roots, to 8 parts of the colature (from 2 to 3 tumblerfuls being given daily) in an obstinate case of *chronic articular rheumatism*, in which all the usual methods of treatment had failed. A striking improvement followed in a few weeks, and in two months the patient, an old man, was practically cured.

S. P. Smirnoff, of Cronstadt (*Meditzinskia Prebavlenïa K'Morskomii Spornikū*, December, 1891 [cited in the same number of the *British Medical Journal*]), next tried the substance on nine patients, sailors and soldiers aged from twenty-two to twenty-seven, of whom six were suffering from *acute* and three from *chronic articular rheumatism*. In all of them the treatment was begun after all ordinary means, including the use of salicylate of sodium, iodide of sodium or potassium, hot baths, local applications of tincture of iodine, turpentine oil, belladonna, mercurial or iodide-of-potassium ointment, etc., had proved quite inefficacious. The remedy was used in the form of a decoction, prepared from 1 or 2 oz. of the fresh stems, with the leaves and roots, in 6 oz. of water, and this amount was given daily in divided doses. The duration of the treatment varied from a week to three months. Of the nine patients, seven were cured, while in the remaining two the remedy failed (in one after a week's course, in the other after three months). In all the cases a slight increase of the daily quantity of urine was observed, and in the patients in whom catarrhal diarrhœa was present that complication quickly ceased under the influence of the decoction. Smirnoff sums up as follows: 1. The results obtained by him must be regarded as exceedingly favourable. 2. The red-bilberry treatment deserves a further extensive trial. 3. The method is extremely simple, convenient, harmless, and cheap (in Russia the red bilberry is one of the commonest of plants). 4. It is advisable to continue the use of the decoction for some time after the complete disappearance of all symptoms, since in one case, which had been cured in five weeks, a relapse occurred three months and a half later. 5. It is useful to combine the internal treatment with local applications of anodynes and counter-irritants. The decoction forms a cinnamon-brown, somewhat turbid fluid, with a slightly bitter and astringent taste and a neutral reaction.

As the author's analysis has shown, the decoction contains vaccinin, tannic acid, extractive, proteid, and mucoid substances, etc. Vaccinin, discovered by Classen in 1865, is a glucoside occurring in the form of white, minute, acicular crystals, which are easily soluble in water but much less soluble in ether, and almost insoluble in alcohol. The glucoside is not identical with arbutin, for the latter is soluble in alcohol and gives a green reaction with perchloride of iron, while vaccinin, when treated with the salt, assumes a cherry-red colour.

VALERIAN, *valeriana* (U. S. Ph.), *valerianæ rhizoma* (Br. Ph.), *radix valerianæ* (Ger. Ph.), consists of the rhizome and rootlets of *Valeriana officinalis*, an herbaceous perennial plant indigenous to Europe and northern Asia. It is cultivated to some extent in this country for use in medicine, but it is said that the roots of the cultivated plants contain a smaller proportion of the volatile oil than those of the wild plants. The roots which grow in a dry soil are smaller but contain a larger proportion of the oil than those from damp situations. When freshly gathered, the root has only a slight fragrance, but as it dries it develops a peculiar odour, which becomes stronger and more unpleasant with the lapse of time. The taste is at first sweetish, but later it becomes unpleasant, camphoraceous, and somewhat bitter. Its colour externally is yellowish or brown, internally white, and when the root is reduced to a powder yellowish gray. Its active principles are soluble in both water and alcohol.

The most important derivative of valerian is its volatile or essential oil, which may be obtained in proportions that vary from 0·5 to 2 per cent. This is a complex substance which, when freshly distilled, is light-greenish or yellowish in colour and of a neutral reaction. Changes are induced by age and exposure to the air which cause it to become of a browner or more deeply yellow colour, and to acquire a strong odour and an acid reaction. These changes are due to oxidation, which results in the formation of certain products, the chief of

which are a hydrocarbon or terpene, $C_{10}H_{16}$, called *valerin*, *valeren*, or *valerene*; a camphoraceous substance known as *valerol*, $C_{12}H_{20}O$; and *valerianic acid*, $C_5H_{10}O_2$. A serious confusion of terms has unfortunately been occasioned by the application of the name valerene to two other hydrocarbons as well as to that derived from oil of valerian. One of these hydrocarbons, known also as amylene, C_5H_{10}, is formed by the interaction of phosphoric oxide and amylic alcohol; the other, $C_{10}H_8$, is obtained from Borneo camphor, and is also called borneene. The chemical formulæ show that these are not identical with the valerene obtained from oil of valerian, which is a terpene.

Valerol appears to be composed of a camphor, with resin and water, a mixture which readily beomes oxidized on exposure to the air into valerianic acid.

Valerianic acid is a colourless, oily, volatile fluid with a very strong odour and a sour, burning, and disagreeable taste. It is soluble in 30 parts of cold water, freely soluble in alcohol, ether, or strong acetic acid, and is a solvent for camphor and some resins. It was first obtained by Chevreul from the oil of the dolphin, and received at that time the name of delphinic acid. This name was afterward changed to the one it now bears when Pentz found it in valerian. It has also been obtained from viburnum, sambucus, and other plants, as well as from organic products of animal life. But it is largely made in the laboratory by the oxidation of amylic alcohol. This last product seems to be chemically identical with the natural acid, but it is alleged that the valerianates made with it do not produce the same physiological effects as those made from acid obtained from valerian.

Valerianic acid is found as an oxidation product in both the oil and the root of valerian, the amount increasing with age and exposure. It is a disagreeable irritant, and does not possess the calmative properties of the oil or of the fresh root. From Reissner's experiments we learn that it coagulates albumin, blood serum, and milk, and that it is slightly irritating to the skin. It increases the rapidity of the heart's action, and weakens it and the respiration as well. It causes weakness, muscular paralysis, convulsions, and death. If death is quickly produced, the gastric mucous membrane will be found to be pale; but if the duration of the intoxication is prolonged, the mucous membrane of the whole intestinal tract will be found to be inflamed, the kidneys congested, the urine turbid and bloody. The characteristic odour is not imparted to the urine or the blood, but it can be detected in the peritoneal cavity. The acid is not itself used in medicine, but several of its salts, the valerianates, are in use and will be described. In addition to these constituents of valerian, Waliszewski has isolated two alkaloids which have been named *valerine* and *chatinine*.

Valerian seems to act very gently as a *general stimulant*, but its principal action is as a *sedative upon the nervous system*, to reduce its irritability, both direct and reflex. It thus acts as an *antispasmodic* in a similar manner to that of asafœtida, musk, lavender, and other drugs of this class. It does not produce any narcotic effects. In small quantities valerian excites a sensation of warmth in the stomach, and acts as a tonic by improving the appetite and digestion. According to Bouchard, the amount of urea excreted is diminished. The usual medicinal doses may irritate the digestive tract, so as not to act as a tonic but to cause gastro-intestinal disturbance. The pulse is also usually accelerated. Larger but yet medicinal doses increase the action of the heart, raise the temperature, and in many persons produce exhilaration, sometimes a slight mental disturbance, with formication of the hands and feet. Very large doses produce dizziness, hallucinations, diplopia, and active delirium with reduced motility, sensibility, and reflex excitability. Such quantities also cause nausea, vomiting, hiccough, diarrhœa, frequent micturition, and tenesmus, together with an increased flow of urine, which contains an abnormally large quantity of urates and lithates. The blood-pressure, as well as the pulse-rate, is lowered by the paralyzing effect of the drug upon the nerve-centres. When used for a long time valerian is apt to cause a condition of depression and melancholy. It is excreted by the kidneys, which are stimulated by it, and also by the lungs and skin. It may cause death in small animals, but is not sufficiently powerful to kill a man. Cats are notably very fond of valerian. It greatly excites their sexual appetite, and finally produces in them violent convulsions.

The range of the therapeusis of valerian is quite small, as it is confined to cases of irregular nervous action which do not depend upon a demonstrable lesion or upon inflammation. It quiets *nervous excitement*, and is a valuable remedy to give temporary relief in all forms of *hysteria*. In *hystero-epilepsy* it is sometimes of great benefit, but in true epilepsy it is seldom, if ever, of any use, unless in rare cases of *petit mal*. It relieves *nervous headache*, and acts as a hypnotic in *insomnia of hysterical origin*. It is rarely, but occasionally, of some benefit in *chorea*. It has proved a valuable agent to relieve the *nervous disturbances incident to the menopause*, the *nervous phenomena of exophthalmic goître*, and also *pruritus of neurotic origin*. It has been successfully employed to relieve *flatulence* in infants, as well as that of hysterical and hypochondriacal subjects, and is useful in the *nervous disorders dependent upon intestinal parasites* in children. It has proved efficient in *cough of nervous origin*, including *whooping-cough*, especially in the *convulsions* and other *neurotic troubles* which result from them, in *delirium with depression*, and in the *coma of typhus fever*. It has been recommended in diabetes mellitus and insipidus, but does not induce any lasting improvement. In its action valerian antagonizes strychnine, brucine, and thebaine, and to the extent of its power is antidotal to those poisons.

The infusion, *infusum valerianæ* (Br. Ph.), may be given in doses of from 1 to 2 fl. oz.

The dose of the tincture, *tinctura valerianæ* (U. S. Ph., Br. Ph., Ger. Ph.), is from 1 to 2 fl. drachms; that of the ammoniated tincture, *tinctura valerianæ ammoniata* (U. S. Ph., Br. Ph.), is from ½ to 1 fl. drachm; that of the ethereal tincture, *tinctura valerianæ ætherea* (Ger. Ph.), and that of the fluid extract, *extractum valerianæ fluidum* (U. S. Ph.), are the same. The best preparation to employ is the oil, which may be given in doses of from 2 to 5 minims in cinnamon water and mucilage. The nauseous taste of the tinctures renders them undesirable. The ammoniated tincture is more useful than the simple tincture, because it combines with the antispasmodic action of valerian the stimulant and carminative effects of ammonia.

The Valerianates.—The salts of valerianic acid are used in medicine to a slight extent. As a rule, their therapeutic value is not great and their effects correspond with those of the bases rather than with those of valerian.

Ammonium Valerianate.—This is the most valuable of these salts and the only one used at all extensively. It occurs in colourless or white quadrangular plates which emit the odour of valerianic acid and possess a sharp, sweetish taste. It effloresces in dry and deliquesces in damp air. It readily forms solutions in water, in alcohol, and in ether which are neutral in reaction, but become acid from the evaporation of ammonia. When the solution is dispensed this acidity, if present, should be neutralized by the addition of a little ammonia, which is also useful to somewhat mask the disagreeable odour and taste of the valerianic acid.

It is probable that small doses of this salt stimulate the functions of the spinal cord and that large ones depress them, but not to such a degree as to render the drug dangerous. It is useful in the same class of cases as valerian—that is, in mild, functional nervous derangements, such as certain forms of *neuralgia*, *headache*, *insomnia*, and *palpitation of the heart*.

Valerianate of ammonium was introduced as a therapeutic agent in 1856 by M. Déclat, who used a preparation known as Pierlot's solution, made by dissolving 1 drachm of valerianic acid in 32 drachms of distilled water, saturating the solution with carbonate of ammonium and adding to the salt thus formed 40 grains of an alcoholic extract of valerian in order to prevent its rapid decomposition. This solution is neutral, is brown in colour, and has a strong valerianic odour. From 6 to 30 drops are given, in water or on a lump of sugar.

The dose of the salt as prepared at the present time is from 2 to 10 grains, which may be given in a pill or in water. The most elegant and the usual mode of dispensing it is in the form of the elixir of the valerianate of ammonium, 1 drachm of which contains 2 grains of the salt.

Amyl Valerianate.—See vol. i, page 62.

Bismuth Valerianate is a non-official, white, amorphous powder, insoluble in water or alcohol, and with a strong odour of valerianic acid. Whatever therapeutic value this salt may possess is probably due to the bismuth alone.

Caffeine Valerianate was tried by Paret in 1875 in *hysteria*. It appeared to act as a *general stimulant* and was sometimes successfully employed to moderate *nervous vomiting* and to mitigate the paroxysms of *whooping-cough*, given in 2-grain pills three times a day.

Antipyrine Valerianate.—This salt has a strong valerianic odour. It is used for the same purposes and in the same doses as antipyrine.

[**Atropine Valerianate.**—See vol. i, page 157.

Cerium Valerianate.—This is a yellowish-white powder which has been employed by Blondeau, in daily amounts of 1½ grain, in the treatment of the *vomiting of pregnancy*, in which it may perhaps have some advantage over cerium oxalate.

Creosote Valerianate.—Dr. E. Grawitz (*Therapeutische Monatshefte*, July, 1896; *Wiener klinische Rundschau*, August 23, 1896) has found this preparation, which is a valerianic-acid ester of creosote, advantageous where creosote is indicated, for the following reasons: 1. Being odourless and tasteless, it is readily taken. 2. Adminstered even in large doses, it seldom gives rise to digestive disturbances. 3. It is comparatively cheap. It comes in the form of gelatin capsules each containing about 3 grains. One capsule a day is enough to begin with, but the number may be increased until from six to nine are taken daily.]

Iron Valerianate is a dark brick-red amorphous powder, of uncertain chemical composition, which is permanent in dry air and has slightly the odour and taste of valerianic acid. It is insoluble in water, soluble in alcohol. It should be kept in small, well-stoppered phials, in a cool and dark place.

This salt was originally proposed for use in a class of cases which combined a condition of *chlorosis* or *anæmia* with *hysterical symptoms*, but very little if any advantage is gained by the addition of the valerianic acid, while several other preparations of iron are preferable for administration. The usual dose is 1 or 2 grains several times a day.

Morphine Valerianate is a non-official salt which has been used in attempts to obtain the desired physiological effects of morphine without the accompanying disagreeable effects, but these attempts have not been attended with any marked success.

Quinine Valerianate.—This salt occurs in white or nearly white, pearly, lustrous, triclinic crystals which have a slight odour of valerianic acid, a bitter taste, and a neutral reaction. It is soluble in 100 parts of water and 5 of alcohol at 59° F., in 40 parts of boiling water, and 1 part of boiling alcohol. It is also slightly soluble in ether. It should be kept in well-stoppered bottles. The aqueous solution is neutral or very slightly alkaline and not stable. It is recommended in doses of 1 or 2 grains three or more times a day in certain nervous disorders, but it is not so efficient

as the combination of the sulphate of quinine with oil of valerian in cases in which quinine and valerian are both indicated.

Goodell has recommended for certain cases of *hysteria* and *nervousness* a combination of the three valerianates of ammonium, iron, and quinine, 1½ grain of each, made into a pill, three times a day.

Sodium Valerianate is a non-official salt which acts in a very similar manner to the valerianate of ammonium, but much less efficiently. It may be used in slight *functional derangements of the nervous system* in doses of from 1 to 5 grains.

Zinc Valerianate.—This salt occurs in soft, white, pearly scales, not deliquescent, with a slight odour of valerianic acid, and a sweet, styptic or metallic taste. It is soluble in about 100 parts of water and in 40 of alcohol, both solutions becoming turbid on boiling.

This salt was introduced into medicine with the idea of combining the peculiar virtues of zinc and valerian so as to form a particularly valuable remedy for various nervous disorders, but it has failed to realize the expectations it excited. It has been tried in quite a number of diseases, but has not proved very effective in any. It is sometimes of use in doses of from ¼ to 3 grains in mild forms of *neuralgia*, and it is said to give relief in *incontinence of urine from a neurotic cause.*

[In the *British Medical Journal* for April 18, 1896, Dr. Peter H. Abercrombie, of the Central London Throat, Nose, and Ear Hospital, reported a case of well-marked *hay fever* in which the administration of valerianate of zinc was followed by a cure, to all intents and purposes. The patient, a strong, healthy man, aged thirty-two years, consulted Dr. Abercrombie early in 1893, when it was learned that he had first suffered from symptoms of the disease when he was sixteen years of age, and ever since had suffered regularly every summer, with greater or less severity according to the weather. The attacks began about the middle of June and lasted about three weeks or a month, the duration of the seizures depending on the dryness of the summer. Sometimes the attacks were so severe as to incapacitate him for business and to require confinement within doors. When he was at the seaside or in town there were never any symptoms or signs of the disease. He had two business offices, one in a large commercial city in Scotland, and the other in a large town some seven miles distant. Between these two places he had to travel at least twice a day. The country through which the railway ran consisted mainly of fields, many of which in summer time contained hay, grasses, etc. It frequently happened that he left one station feeling perfectly well, but had an attack in the train when passing the fields, which disappeared by the time he reached the other station. Prior to the employment of the treatment suggested by Dr. Abercrombie, the only remedies used had been local. These had sometimes relieved the symptoms, but only for a very short time. The patient had been advised to go to the seaside. There was a history of nervous affections in his family, and the patient himself was distinctly neurotic. This led Dr. Abercrombie to prescribe valerianate of zinc as a nerve tonic. Early in 1893 he prescribed: 1. Three-grain pills of zinc valerianate, one to be taken three times a day, after meals, and this treatment to be begun a full month before the onset of the attack was expected and continued for at least two months. 2. As local palliative measures, if required, a 5-per-cent. solution of cocaine hydrochloride for spraying the nose and throat, and a snuff of bismuth, morphine, etc. The patient went to the seaside that summer, but in 1894 and 1895 he remained inland, followed the treatment laid down for him, and escaped the disease.]—Matthias Lanckton Foster.

VALERIANIC ACID.—See under Valerian and Viburnum Prunifolium.

VALEROL.—See under Valerian.

VALZIN.—See Dulcin.

VANILLA (U. S. Ph.), *fructus vanillæ* (Ger. Ph.), is probably destitute of any medicinal properties and is only used as a flavouring agent. Cases of poisoning have been ascribed to it, but it is probable that the active agents have been one or another of the ptomaine group derived from the decomposition of the food flavoured with it.

Russell H. Nevins.

VANILLIC ALDEHYDE, VANILLIN, $C_6H_3OH.OCH_3.CHO$, an odorous principle found in vanilla pods, is a colourless substance soluble in 8 parts of water. It is chiefly used as a flavouring agent, but is occasionally given as a *stomachic* in *dyspepsia*, in daily amounts of from ¾ to 3 grains.

VAPOURS.—Vapours, also called inhalations, are fumes more or less charged with medicinal agents, which are volatilized by spontaneous evaporation, or by heat, or by a current of gas or air. They may be divided into *dry* and *moist vapours.*

Dry Vapours.—These are derived from the evaporation of substances readily volatilizing at the ordinary temperature. Substances of this nature are acetic ether, ethyl iodide, amyl nitrite, compound spirit of ether, ammoniacal preparations, ethereal tinctures, etc. These are inhaled either from the phials in which they are contained or from gauze, a handkerchief, or other medium to which portions of them are applied. Less volatile substances may be combined with more volatile ones. Thus, camphor may be dissolved in ether or alcohol. The same may be done with volatile oils, iodine, and bromine. Instead of ether or alcohol, some other volatile liquid, itself possessing desirable medicinal properties, such as chloroform, bromoform, etc., may be used. If the vapour given out by such a combination is too strong for the air-passages, the preparation may be suitably diluted or the vapour may be drawn through a layer of cotton.

Among the dry vapours may also be classed the inhalation of vapours of anæsthetic agents, such as ether, chloroform, nitrous-oxide gas, etc. The former are always administered so that a certain amount of air may reach the lungs of

the patient. Recently a new method of administering these agents has been introduced, which consists in passing a current of oxygen gas through the liquids and making the patient inhale the gaseous mixture thus produced.

Moist Vapours.—These may be cold or warm (even hot). Vapour of hot water alone is often beneficial. Usually the medicinal substance, which must be volatilizable by the vapour of water, is dissolved in or added to the water in a suitable inhalation apparatus, and air drawn through it for breathing. In this way creosote, eucalyptol, fir-wood oil, and similar agents are usually administered. Chlorine gas is generally inhaled from a mixture of chlorinated lime with a suitable quantity of cold water. Inhalation of hydrocyanic acid is directed by the Br. Ph. to be effected from a solution of from 10 to 15 minims of the official 2-per-cent. acid in 1 fl. oz. of cold water; inhalation of iodine, according to the same authority, by adding 1 fl. oz. of tincture of iodine to 1 fl. oz. of water, gently heating it, and drawing air through it. (See also INHALATION and under INSUFFLATION [vol. i, page 533].)—CHARLES RICE.

VARNISHES.—These are preparations designed for topical application in the form of liquids which dry more or less rapidly and so form a coating over the part. Apart from collodion and solutions of gutta-percha, celloidin, and celluloid, the varnishes now in use are mostly preparations devised by Dr. P. G. Unna, of Hamburg, consisting chiefly of tragacanth. Recently Dr. Unna has improved them by the addition of gelatin, forming a mixture which he calls "*gelanth*," or "*gelanthum*," "an almost ideal watery varnish." Dr. Unna (*British Medical Journal*, October 17, 1896) says, after two years' experience in the use of gelanth, that he had long known that all the familiar watery varnishes had many disadvantages, of which the most important were want of activity and an insufficient distribution of the drugs they contained. But the simple and cleanly application, and the cheapness of these varnishes, led him to continue their use in suitable cases—namely, for slight *superficial erythema* and *eczema*, with skins which did not stand fat well, and with patients who objected to grease. The watery varnishes were a necessary evil, he says, though one could not prescribe them with absolute confidence in serious cases of skin diseases. The greatest technical defect of all watery varnishes, and especially those of tragacanth, is that the insoluble drugs, such as zinc oxide, sulphur, and chrysarobin, do not remain suspended, but are deposited on the surface in a gradually hardening layer. But if one so increases the amount of tragacanth that the power of suspension of the swollen mass is sufficient to keep heavy powders in permanent suspension, we get a porridgy, lumpy mass, which can not be evenly mixed with medicaments. These are indeed better suspended, but they are badly distributed.

On the other hand, says Unna, there is in a strong gelatin solution an ideal power of suspension and one of fine distribution of the medicaments at the same time. But this, mixed with the tragacanth, would give to the latter the undesirable quality of being capable of being spread only when warm. If, however, a very small proportion of gelatin is added, up to 2·5 per cent., and at the same time, by moderate overheating, the gelatin has its power of gelatinizing diminished, a mass is obtained which only feebly gelatinizes, but can be spread in a very thin, uniform layer upon the skin, and at the same time preserves its quality of finest distribution of the drug. Certainly it does not possess the power of suspension of the stronger solution of gelatin, he adds, but this is supplied by the other constituent, tragacanth. Equal parts of each provide a vehicle of a new character, in which the insoluble medicaments are both distributed as finely as possible and permanently suspended. By the admixture of gelatin the tragacanth gains not only the power of reducing all drugs to a very fine distribution, but also a second advantage—namely, the rapid drying to an absolutely smooth and not in the least sticky covering. This quality is especially important for the incorporation of hygroscopic material, such as ichthyol, in watery varnishes.

As the physical properties of the gelatin help those of the tragacanth, says Unna, so do those of the tragacanth aid those of the gelatin. The overheated gelatin would alone not provide a good varnish, for it would have become almost fluid. The drugs suspended in it, though evenly mixed, would be distributed irregularly along with the almost fluid gelatin. Like the ink on paper and the artist's colours on canvas, the gelatin which is to be spread on the skin needs something to give it body resistance, and this is supplied in an excellent manner by the swollen tragacanth. Although it has taken up a considerable amount of water, the gum still has the resistance of a stiff paste, and is therefore very well qualified to give to the gelatin the necessary body. By the addition of the tragacanth the gelatin gains a further advantage not so readily foreseen, but one which has proved far more important than the former. On the envelopment of every particle of gelatin by the tragacanth probably depends, says Dr. Unna, the remarkable compatibility and the indifference of the gelanthum to large amounts of those drugs which can not be used with a simple gelatin solution, such as salicylic acid, resorcin, corrosive sublimate, etc. The power of incorporation of the gelanthum with the most varied drugs, which it owes entirely to the tragacanth, is extreme. It may be mixed with 50 per cent. of ichthyol, 40 per cent. of salicylic acid, resorcin, and pyrogallol, up to 5 per cent. of carbolic acid and 1 per cent. of corrosive sublimate without influencing its value as a varnish. Two incompatible bodies, such as salicylic acid and oxide of zinc, or ichthyol and salts, substances which combine in a watery solution, or precipitate, remain in gelanthum without any mutual action. Gelanthum thus lends itself to the use of several remedies together. To this possibility of

combining large amounts of the most active medicaments gelanthum owes also a degree of activity previously unknown in watery varnishes. With the addition of from 10 to 20 per cent. of salicylic acid to any desired medicine (chrysarobin, pyrogallol, resorcin, or tar), gelanthum treatment, says Dr. Unna, may be applied with all its advantages of cleanliness, circumscribed action on the diseased areas only, drying, and cheapness, in severe cases of *psoriasis* and *dry eczema* with marked thickening of the epidermis. Where much grease is not required, as in many *eczemas of the hand, excessively dry skin, fissures*, etc., he continues, one can replace the ointment with the gelanthum, which naturally to most patients is very much pleasanter.

The mode of preparing gelanthum is described by Dr. Unna as follows: Pieces of crude tragacanth are emulsified for four weeks in the cold, with twenty times their volume of water. They are then treated with steam for one day, further swollen, and finally pressed through muslin. The gelatin, on the other hand, is swollen up cold, and then filtered in his steam filter, after long exposure to steam pressure, which takes from it part of its power of gelatinizing. The mixture of the two is allowed to swell for two days in steam. After being pressed once more through muslin, it is mixed with 5 per cent. of glycerin, some rose water, and 2 parts to 10,000 of thymol, in order to prevent the growth of fungi. Gelanthum contains about 2·5 per cent. of gelatin and tragacanth.

Dr. Unna thus sums up the advantages of gelanthum as compared with the older watery varnishes: 1. It may be better spread. 2. It dries more rapidly and with a smoother surface. 3. It feels more cooling, on account of the greater amount of water it contains. 4. It keeps the drugs suspended and distributes them more evenly on the skin. 5. It may be combined with drugs, either singly or in combination. 6. It permits of the drying of hygroscopic drugs such as ichthyol. 7. It permits of the addition of grease. 8. If protected from drying, it may practically be kept forever.

An *antiseptic* varnish known as *adhæsol* is made, according to Professor Coblentz, of 350 parts of copal resin, 30 of benzoin, 30 of balsam of Tolu, 20 of oil of thyme, 3 of alpha-naphthol, and 1,000 of ether.

For Unna's carbolized ichthyol varnish, see under ICHTHYOL (vol. i, page 523).

VASCULAR SEDATIVES, VASCULAR STIMULANTS.—See CARDIAC STIMULANTS, TONICS, AND DEPRESSANTS.

VASELINE.—There are various bland, tasteless, and odourless fatty products of the distillation of petroleum, all of which are characterized by not becoming rancid. The three chief members of the group, those that are official, are distinguished in accordance with their consistence at ordinary temperatures. Liquid vaseline, or cosmoline, *petrolatum liquidum* (U. S. Ph.), *paraffinum liquidum* (Ger. Ph.), is a colourless or slightly yellowish oily liquid. It is employed as a *lubricant* and as an oily vehicle for certain drugs to be applied in solution, especially in the form of a spray. Soft vaseline, or ordinary vaseline, *petrolatum molle* (U. S. Ph.), *paraffinum molle* (Br. Ph.), is a whitish or yellowish greasy substance of about the consistence of lard. Hard vaseline, *petrolatum spissum* (U. S. Ph.), *paraffinum durum* (Br. Ph.), *paraffinum solidum* (Ger. Ph.), varies somewhat as defined in the different pharmacopœias. The U. S. Ph. describes it as a fatlike mass of about the consistence of a cerate, varying from white to yellowish or yellow; the British and German preparations are paraffin (*q. v.*).

Soft vaseline is the variety almost always meant when one of the other forms is not specified. It is used largely as a base for ointments and as a *lubricant*.

Köster (*Therapeutische Monatshefte*, June, 1896; *Therapeutic Gazette*, October, 1896) treats *erysipelas* by applying vaseline to the affected and surrounding parts twice a day; linen is laid over the vaseline, and a mask is made if the part affected is the face. The dressing is held in place with gauze bandages. In other respects the treatment is symptomatic—with acetanilide or antipyrine for severe headache, and the same remedies, or quinine, when the temperature rises above 100° F. Ice-bags are applied to the head, and laxatives, chloral, digitalis, and alcoholics used as indicated. The advantages of this method are said to be the following: It can be used even upon the hairy scalp; smarting, burning, and disagreeable odours are avoided; and the remedy is cheap.

VASELONE.—This is a proprietary ointment base said to consist of a solution of stearone and margarone in a neutral mineral oil. It may be used for the same purposes as vaseline.

VASOGEN, or *oxygenated vaseline*, is a new German ointment base said to be vaseline treated with oxygen to such an extent as to contain free oxygen. According to Professor Coblentz, another statement is that it contains about 25 per cent. of olein saponified with anhydrous ammonia, mixed with vaseline, and brought to a suitable consistence with vaseline oil. As it mixes readily with many drugs that have important topical uses, such as iodoform, creosote, ichthyol, menthol, pyrogallol, chrysarobin, creolin, camphor, etc., and is readily absorbed, it is likely to come into extensive use.

Dr. Leistikow (*Monatshefte für praktische Dermatologie*, 1895; *Annales de dermatologie et de syphiligraphie*, April, 1896) has employed *iodized vasogen* containing 6 per cent. of iodine. In a case of recent *secondary syphilis* a course of frictions with iodized vasogen caused the symptoms to disappear rapidly, but the patient was seized with violent headache which resisted every remedy, even iodine given internally. Daily frictions of the scalp with 75 grains of the vasogen preparation caused decided improvement in three days and a complete cure in three weeks. In a woman with extensive *nodes* of the tibia which had been only slightly improved by frictions the appli-

cation of carbolized mercurial plaster, and iodine given internally, frictions several times a day with iodized vasogen caused their complete disappearance in fourteen days. In a case of *sciatica*, probably of syphilitic origin, also in six cases of ano-genital *mucous patches*, and a case of pigmentary syphilide of the neck, the iodized vasogen proved efficient. In the case last mentioned other treatment had been ineffectual. In three cases of lupus vulgaris the results of the use of iodized vasogen were absolutely negative. In a case of ulcerated gumma cicatrization took place more rapidly than with any other treatment. Leistikow ascribes the superiority of iodized vasogen over other topical remedies for syphilis to the fact that the absorption of iodine is very rapid.

VENESECTION.—See BLOODLETTING.

VERATRINE, *veratrina* (U. S. Ph., Br. Ph), *veratrinum* (Ger. Ph.), is the name applied to a mixture of alkaloids obtained from the seeds of *Asagræa officinalis*, a bulbous plant of the natural order *Liliaceæ*, indigenous to Mexico and Central America. It is a white or grayish-white amorphous or semi-crystalline powder, permanent in the air, odourless, but causing intense irritation and sneezing when even a minute quantity touches the nasal mucous membrane, with an acrid taste, leaving a sensation of tingling and numbness on the tongue. It is very slightly soluble in cold or hot water, is soluble in 3 parts of alcohol at 59° F., in 6 parts of ether, in 2 of chloroform, and very soluble in boiling alcohol.

There seems to be considerable doubt in regard to the exact chemical constituents of the seeds of the plant, and the name veratrine has been applied to more than one of them. The veratrine of Merck appears to be identical with the cevadine of Wright and Luff, and occurs in anhydrous, transparent needles or compact crystals which effloresce in the air and become opaque, while the veratrine of Wright and Luff is an amorphous, resinous mass obtained from the mother liquor of the preceding by extraction with ether. On account of this uncertainty, no further description will be attempted of the constituents of this powder or of the various alkaloidal substances known by this name.

Experiments on the lower animals indicate that the physiological action of the official veratrine is principally upon either the peripheral nervous system or upon the muscular tissue itself. It does not appear to affect the brain, but it excites the voluntary muscles, or possibly their controlling centres in the spinal cord, so as to give rise to tonic tetanic convulsions, which in some respects resemble those induced by strychnine, and are followed by paralysis and loss of muscular contractility. Death results from the general paralysis in which the muscles of respiration as well as the heart are involved. The heart stops in diastole. After death the muscles are found to have lost their ability to respond to electrical stimulation to a very great extent if not entirely.

The ingestion of veratrine in man is apt to be provocative of severe vomiting and diarrhœa, sometimes of diuresis. The force and frequency of the heart's action are reduced in direct proportion as the size of the dose increases until it is rapid, irregular, and feeble. The temperature is also reduced. No fatal case of poisoning is on record, but alarming symptoms have followed the ingestion of $\frac{1}{16}$ of a grain. In an experiment upon himself, Esche took half a grain of the acetate, and the toxic symptoms which resulted are described as collapse, a pale, cold, wet skin, pinched features, a rapid, thready, irregular pulse, with violent vomiting, and marked muscular tremor.

When applied to the skin, veratrine excites a sensation of warmth followed by tingling, and may cause an erythema or, less often, a pustular or petechial eruption. When the epithelium has been removed it is a very powerful irritant. Upon the mucous membrane it is also very irritating and causes sensations of burning and numbness in addition to symptoms characteristic of the membrane irritated, such as salivation from its application to the mucous membrane of the mouth or sneezing when applied in the nose.

Veratrine has been used internally in a great variety of diseases, in doses of from $\frac{1}{60}$ to $\frac{1}{15}$ of a grain, but it has proved unreliable and dangerous, and such use has been abandoned. Its ability to reduce the pulse and temperature led to its employment in pneumonia and other febrile diseases, but no advantage was gained from its use, which was necessarily confined to sthenic fevers in robust patients. Dysmenorrhœa, heart disease, chorioiditis, hysteria, and epilepsy may be mentioned as a few examples of the diseases for which this drug was once prescribed.

At present veratrine is employed only for external use, principally as a *counter-irritant* or as an *antiparasitic*. As a counter-irritant it has been used in *superficial neuralgias*, *pleurodynia*, *chronic pleurisy*, *tic douloureux*, and *myalgia*, as well as *chronic enlargement and stiffness of the joints*, but it does not present any special advantage over the counter-irritants more commonly in use. As an antiparasitic, it has proved useful in *phtheiriasis*, *alopecia areata*, and *aspergillus infection*. Two other purposes for which veratrine is said to have been used are to promote the nutrition of the muscles in *infantile paralysis* and, by dentists, to obtund the sensitiveness of dentin.

The official preparations of veratrine are the ointment and the oleate. The ointment, *unguentum veratrinæ* (U. S. Ph., Br. Ph.), is composed, according to the U. S. Ph., of 4 parts of veratrine, 6 of olive oil, and 90 of benzoinated lard; the Br. Ph. orders 1 part of veratrine, 14 parts of hard paraffin, 41 parts of soft paraffin, and 7 parts of olive oil. This ointment is the preparation generally employed, but frequently requires to have its strength reduced before application. It should never be applied to a raw surface, not only on account of the intense irritation which it would there produce, but also because of the danger of absorption of the drug and consequent poisoning. The

oleate, *oleatum veratrinæ* (U. S. Ph.), is composed of 2 parts of veratrine and 98 of oleic acid. This was intended to take the place of the ointment when inunction rather than counter-irritation was desired, but the value of the drug, except as a counter-irritant or antiparasitic, is at best very doubtful. When the oleate is used care must be taken to avoid the absorption of too large an amount of the drug.

Peugnet recommends for the treatment of *aspergillus in the ear* a solution composed of 2 grains of veratrine, 10 minims of acetic acid, and ½ oz. each of rose water and glycerin.

MATTHIAS LANCKTON FOSTER.

VERATROIDINE.—See under VERATRUM VIRIDE.

VERATROL, $C_8H_{10}O_2$, the dimethyl ether of pyrocatechin, a colourless oil, of an agreeable aromatic odour, that has recently been introduced as an *antiseptic*. According to Surmont and Vermersch (*Gazette médicale de Paris*, August 3, 1895), the bacillus of cholera, that of typhoid fever, and that of diphtheria are susceptible to its action, and the bacillus of tuberculosis in human beings does not seem to thrive well in its presence, but the *Bacillus pyogenes cyaneus* and the *Staphylococcusp yogenes aureus* are less energetically influenced by it.

VERATRUM ALBUM.—See HELLEBORE, WHITE.

VERATRUM NIGRUM.—See HELLEBORE, BLACK.

VERATRUM VIRIDE (U. S. Ph.), *veratri viridis rhizoma* (Br. Ph).—This is the rhizome and roots of *Veratrum viride*, American, or swamp hellebore, Indian poke, or poke root, a large perennial herb which belongs to the natural order *Liliaceæ* and is indigenous to the Northern United States and Canada. It is found in marshy places, on the borders of damp thickets, and by the sides of small streams as far south as Georgia. The roots are usually collected in the autumn, after the leaves have fallen, but some doubt has been expressed as to whether they are not equally good if collected in the spring, before the flowering season. They deteriorate in quality by the lapse of time and should not be kept more than a year. The root is of a bitter, very persistent and acrid taste, and of a disagreeable odour when fresh, but this disappears in the process of drying. The powdered root is irritating to the skin and mucous membranes and causes sneezing when snuffed, even in very minute quantity, into the nostrils.

Historically, there is little to be said in regard to this drug. We know that the aborigines were acquainted with its peculiar intoxicating qualities, and some tribes are said to have used it as an ordeal or test of strength and vigour. It was and still is used to some extent by farmers to destroy vermin on plants and bushes, as well as to intoxicate birds which infest planted fields, so as to render them easy to capture. As an *antiparasitic* and *counter-irritant* it has yielded place to more satisfactory agents. Its introduction into medicine as a *cardiac depressant* may be said to date from the publication of a paper by Dr. Osgood, in 1835, which was followed by the investigations of Dr. Norwood. Since then the drug has been the subject of considerable study, and various analyses of it have been made, with results which are very confusing. Probably several alkaloids are present which are not easily separated from the resin associated with them, and the most satisfactory analysis yet made is that by Wright and Luff, who found the plant to contain jervine, pseudo-jervine, cevadine, a very little rubijervine, and traces of veratrine and veratalbine. Some authors adhere to Bullock's analysis, who found two alkaloids, jervine and veratroidine, and in the principal experiments to determine the physiological action of the active principles of this drug these have been employed. These experiments were conducted by Dr. H. C. Wood, and the following descriptions of jervine and veratroidine are largely taken from his work:

Jervine is present in larger quantities in *Veratrum viride* than any other alkaloid, is of a bitter taste, and forms crystallizable salts with acids, but has not yet been employed by itself in medicine. The first symptom produced in one of the lower animals by a dose of jervine is a disposition to be quiet, associated with muscular weakness. Soon rapidly repeated thrills run through the muscles and cause violent trembling. Finally, the animal is unable to stand, and at about this time violent epileptoid convulsions occur—general clonic spasms without rigidity. These convulsions are lacking in force even when most violent, and they continue, growing less severe as the prostration increases and alternating with periods of relaxation until death. Sensation is not affected until late in the poisoning, when it disappears. Consciousness is preserved to the last. The pupils are not affected. Salivation is profuse, but no vomiting or purging is induced.

At first, while the animal is standing quietly the frequency of the pulse is lessened, but the convulsions and sometimes the violent trembling which precede them occasion a change to great rapidity. This effect seems to be due to a direct action of the drug upon the cardiac muscle or ganglia, as well as upon the vaso-motor nerve-centres. The arterial pressure is greatly lowered, falling progressively from beginning to end of the poisoning. It is not certain whether the convulsions are induced by the irritation of the motor centres in the brain by the drug, by the accumulation of carbon dioxide in the blood, or by the cerebral anæmia caused by the depressed circulation. Neither the pneumogastric centre, the peripheral motor nerves, nor the voluntary muscles appear to be affected. Reflex action is diminished and finally abolished. Death results from asphyxia due to cessation of respiration.

Very little more is known of the action of *rubijervine*, when dissociated from the resin with which it is combined in veratroidine, than that it is a circulatory depressant and that it induces vomiting and purging.

Veratroidine is more irritating than jervine, causes muscular twitchings or convulsions of

less severity, and acts in a similar manner upon the spinal cord. It is a very powerful respiratory poison. Its action upon the circulation and upon the pneumogastrics is very peculiar. Wood says: "After a hypodermic injection of the poison the rapidity of the pulse and the arterial pressure are at first decidedly lessened. After a time, the pulse still remaining very slow, the individual heart-beats become endowed with a force greatly beyond normal, and the arterial pressure becomes normal; then suddenly the pulse-rate becomes very rapid, the individual cardiac beats losing much of their extraordinary vigour, but the arterial pressure rising nearly 50 per cent. beyond its original position." These effects would seem to be produced by the primary stimulation of the cardiac inhibitory apparatus—whether of the controlling centre or not is uncertain—followed by the results of irritation of the vaso-motor centres by the accumulation of carbon dioxide in the blood induced by paralysis of the respiratory centre. The latter appears to be the occasion of the great rise of blood-pressure, as the drug does not seem to have any influence over the vaso-motor nerves. "It is a powerful respiratory poison, lessening at first the frequency of the cardiac beat by stimulating the pneumogastrics, but soon losing all control over the heart, owing to the powerful influences which the induced asphyxia exerts." Small doses of veratroidine stimulate the cardiac inhibitory apparatus, while larger ones paralyze it, according to Professor Wood's observations.

The resin which remains after the extraction of the alkaloids is somewhat irritating to the gastro-intestinal tract.

The physiological action of veratrum viride is that of a powerful spinal and circulatory depressant. To quote Wood once more: "In full therapeutic doses it lowers the pulse-rate both by direct action on the muscle (jervine), and by stimulating the inhibitory nerves (veratroidine): it diminishes the force of the heart-beat by a direct influence on the cardiac muscle (jervine) and produces a general vaso-motor paralysis (jervine)."

When small doses of veratrum viride are given, the force of the heart is lessened, the rate is at first not affected, but later becomes slow, and the pulse is soft and moderately full. This condition persists while the body remains perfectly quiet, but the slightest exertion is apt to cause the pulse to become very rapid, small, and even imperceptible. This is associated with great muscular weakness, lowered temperature, nausea, and vomiting, but rarely with catharsis. In this respect it usually exhibits a marked difference from its near relative, veratrum album. Sometimes it occasions the appearance of an erythematous or pustular eruption on the skin. The rapid and feeble condition of the pulse precedes the nausea, which is also occasionally absent, and is therefore not dependent on the gastric disturbance. Larger doses induce a greater intensity of the symptoms, which become very alarming. The condition now is one of collapse characterized by an almost imperceptible pulse, a cold, clammy skin, incessant retching, absolute muscular prostration, giddiness, loss of vision, mydriasis, and semiconsciousness. Reflex action is impaired, but sensation is not affected. Excretion is indirectly increased by the relaxation of the tissues, but there is probably no direct interference with this function.

In spite of the very formidable symptoms, death very rarely occurs from poisoning with veratrum viride. Recovery after the ingestion of an ounce of the tincture has been reported, and recently Dr. J. B. Tuttle recorded a case in which four teaspoonfuls were taken, instead of four drops, within an hour, with no worse result than severe vomiting, pallor, and prostration. The prompt emesis and the consequent removal of the unabsorbed drug probably furnish the correct explanation of such cases. Death has occurred a few times. In cases of poisoning the head should, if possible, be placed on a lower plane than the rest of the body, and heat should be applied externally while strychnine, atropine, and other stimulants are administered internally.

Opinions differ very widely in regard to the therapeutic value of this drug. One author asserts that it is the safest and best circulatory depressant which we have for adults, while another maintains that it is seldom useful, but almost always harmful. The beneficial power which it exerts has been ascribed to its sedative action on the nervous system, but the weight of evidence is in favour of the view that it depends upon its action on the circulation. It is not a drug to be recommended or used blindly in certain pathological or inflammatory conditions. When used in that manner, it is apt to be worse than useless, but when used judiciously in the proper indicatory conditions, veratrum viride is of great value.

It is frequently of good service during the earliest stage of many parenchymatous and serous inflammations—i. e., during the stage of congestion or hyperæmia—particularly when they occur in sthenic subjects. Thus, its employment is often advantageous in *pneumonia*, *pleurisy*, *hepatitis*, and other acute inflammations of the viscera, but as soon as this early stage is passed it is not only useless but contra-indicated. It should not be used in gastritis, peritonitis, or other visceral inflammation where the vomiting it is apt to provoke is likely to do harm, unless it is combined with other drugs which will correct this tendency to emesis. It has been recommended to prevent or ameliorate the severity of inflammations which result from injuries of the abdomen.

Small doses frequently repeated, especially when combined with morphine, often determine resolution in *amygdalitis*. Its ability to moderate the force of the circulation is sometimes made use of to aid in checking *hæmorrhage* and to favour the formation of a clot in an *aneurysm*. In the latter case the patient must be kept in a recumbent posture and on a proper regimen, while the dose given should be small and its effect carefully watched. In the *abnormal cardiac tension of renal disease* and in *acute mania* veratrum viride is often of good service. In *puerperal eclampsia* excel-

lent results have been reported from the use of very large doses. It is highly esteemed in *hypertrophy* and *irritability of the heart*, but it must never be used when there are valvular lesions, dilatation, or a weak or fatty condition of the cardiac muscle. The indications for its use in heart diseases nearly correspond to the contra-indications for digitalis. Successful results have been reported from its use in *exophthalmic goître*. Formerly it was used to a considerable extent as an antipyretic in *rheumatism*, but this use has become almost if not quite obsolete.

A case of persistent *priapism* which had resisted treatment with a large number of other drugs, but finally succumbed to veratrum viride, is reported by Walker.

The use of this drug is contra-indicated in all conditions which are characterized by adynamia, depression, or exhaustion. Thus, its use is inadmissible in typhoid fever and in delirium tremens, although in some cases of *cerebral irritation from drink*, in which a strong bounding pulse is present, it may perhaps be of service.

The official preparations are the tincture and the fluid extract. A non-official saturated tincture, known as Norwood's, is sometimes used. For the purpose of reducing the severity of an *incipient inflammation* one or two drops of either the official tincture, *tinctura veratri viridis* (U. S. Ph., Br. Ph.), or the fluid extract, *extractum veratri viridis fluidum* (U. S. Ph.), every half hour for two or three hours, are usually about the requisite doses. Its use should be maintained only until the skin is moist and relaxed and the pulse slower, or till there is slight nausea. In the cardiac troubles in which it is indicated 5 drops three times a day are usually sufficient. In puerperal eclampsia such large doses have been recommended as half a drachm every fifteen minutes till vomiting is produced or the convulsions cease.

[To combat the vascular excitement of *puerperal phlebitis*, the late Dr. Fordyce Barker preferred veratrum viride to all other drugs (*Puerperal Diseases*, New York, 1874). He says: "I meet with many who have a great fear of the veratrum viride, because it sometimes produces the appearance of dangerous collapse. But this is a very temporary condition, which, so far as I have heard, has never terminated disastrously. The appearance of one who has taken too much veratrum viride is almost precisely like that produced by tobacco in those unaccustomed to its use. I have often seen this, but now, when I do, it causes no alarm, as I am sure that the effects will soon pass off." He adds that there is no objection to assisting reaction in such cases by carbonate of ammonium or small quantities of some alcoholic stimulant. In a small percentage of cases, he says, it is quite apt to cause nausea, but this is readily counteracted by giving it in combination with tincture of ginger. As to its positive effects, he says that one can by it absolutely and certainly control the frequency of the pulse of inflammation and of irritation, but of course if it will accomplish this, one would not expect to reduce the rapid pulse of exhaustion, as found in the last stages of phthisis or in typhus fever.

Dr. Barker remarks that the use of veratrum viride is not incompatible with that of stimulants. He alludes to a case in which the veratrum viride did not seem to produce any effect on the pulse, which remained constantly above 130, until the condition of the patient was such that he decided to give brandy. After the first ounce had been given the pulse fell to 108; after the second, to 86. The use of brandy was continued and that of the veratrum viride was suspended for a few hours, and the pulse again rose to 130. After this, if the use of either agent was suspended, the pulse would rapidly increase in frequency, while under the combined influence of the two it was kept below 80. Another of his patients, who recovered, took an ounce of brandy and from 3 to 10 drops of the tincture of veratrum viride every hour for two days, the quantity of the veratrum viride being regulated by the frequency of the pulse, which was never allowed to rise above 80, although it sometimes fell to 40.

The directions which he generally gave to his house staff in Bellevue Hospital were, to begin the use of the veratrum viride at once, and, carefully watching its effects, bring the pulse down to 80 and hold it there. After the specific effect of the veratrum is once produced, he says, it can be kept up by very much diminished doses.

In *puerperal peritonitis* also Dr. Barker relied on veratrum to reduce vascular excitement. He says: "I regard it as very important to allay vascular excitement, as this necessarily leads to a rapid depression of the vital forces. Our predecessors resorted to venesection to accomplish this, but the general experience of the profession led to the universal abandonment of this practice, as it was found that in this disease it involved absolute loss of vital power. But in the veratrum viride we have an agent which reduces vascular excitement without real loss of vital power. There is a positive distinction between depression of the vital forces and absolute loss of power." In conjunction with the use of morphine, he thought it well in puerperal peritonitis to gradually reduce the frequency of the pulse by the use of tincture of veratrum viride, beginning with 5 drops with each dose of morphine. By carefully watching the effects, and graduating the doses short of provoking vomiting, one may, he says, bring the pulse down to 70 or 80, and then one should endeavour to hold it there. Even if vomiting does come on, and, for a time, the patient seems almost in a state of collapse, this condition need excite no alarm, as it lasts but a short time, and the pulse is effectually reduced in frequency, sometimes to 30 or 40 a minute. He has seen this occur a hundred times at least, he says, and the greatest evil resulting from it is the alarm and excitement which it causes to the friends and attendants. It is therefore desirable to avoid this explosion, so to speak, of the action of veratrum viride, if possible. If the pulse has once been reduced,

according to Dr. Barker, 3 drops, 2 drops, or even 1 drop, may be found sufficient to control it.

Veratrum viride has been extensively used in the United States, especially in the South, in the treatment of *puerperal convulsions*. In the *Medical Record* for September 7, 1889, Dr. Richard Cole Newton, of Montclair, N. J., says that twenty-eight years before, Dr. Cutler, of Jersey City, stated in the New Jersey Academy of Medicine that he had been in practice twenty-five years, and that during that time he had seen on an average eight cases of puerperal convulsions a year, in his own practice and in consultation, that he had never lost a case, and that in treating this complaint he relied upon veratrum viride. Dr. Love, who was present and heard these remarks, and shortly afterward had his attention called by the late Dr. Isaac Nichols, of Newark, to the use of benzoic acid in the treatment of the *albuminuria of pregnancy*, put the hints dropped by these men together, and concluded to treat his next case of eclampsia with veratrum viride and benzoic acid. Dr. Love has had in all twenty-three cases, and he reports twenty-three recoveries.

The last case was that of a primipara twenty-three years of age. Her urine was highly albuminous on April 30th. In spite of treatment, by May 15th her water had diminished to less than five ounces per diem. It resembled pea soup in appearance, and when boiled with nitric acid it promptly solidified. She then fell into convulsions and had six in twenty-four hours. During this time she remained totally unconscious. As it was difficult to make her swallow, and as the veratrum viride given by the mouth was vomited, 8 minims of Norwood's tincture were given hypodermically, but this also produced vomiting. This amount was, however, injected under the skin every hour until five or six doses had been given. The benzoic acid was also given every four hours.

Dr. Love says that, in his experience, within twenty-one days after the first spasm labour will come on, and that the fœtus is generally dead. Only two children in his twenty-three cases survived. His plan of treatment, says Dr. Newton, was as follows: Give 3 drops of Norwood's tincture (a freshly prepared portion) and repeat it in an hour; then 2 drops every hour or two until the patient experiences a cordlike feeling in the neck. If the nurse is not sufficiently intelligent or conscientious, the physician must give the veratrum viride himself. The benzoic acid is given in the following prescription, which is taken from Ellis's *Formulary:*

℞ Benzoic acid..... 2 dr.;
Potassium bicarbonate..... ½ oz.;
Spirit of nitrous ether..... 1 fl. oz.;
Solution of ammonium acetate.. 2 fl. oz.;
Syrup of lemon, enough to make 6 fl. oz.
M. S.: A tablespoonful every four hours.

In a letter published in the *New York Medical Journal* for December 14, 1895, called forth by a discussion to be mentioned presently, Dr. Newton recurs to the subject, and says that, if it seems to be indicated, a large dose of calomel is given at first, and its action may be aided by large warm enemata. If the bladder is full and does not empty itself when the bowels act, the water is drawn. The point upon which Dr. Love strenuously insists, and upon which he disagrees with the weight of authority, is *absolute non-interference with the contents of the uterus*, so far, at least, as the convulsions are concerned. He denies that emptying the uterus stops the convulsions, and affirms that where the nervous system is already so poisoned that death from shock is imminent, any further strain upon the thread of life, already stretched nearly to the utmost, is an unjustifiable and needless risk. In certain cases he would not hesitate to bleed, but considers this, as a rule, quite unnecessary. For the immediate control of the spasms he would use chloroform if he thought it indicated.

When the accoucheur is called to a woman in puerperal convulsions, says Dr. Newton, he should occupy himself entirely with the control of these phenomena and with the elimination of the *materies morbi* so far as practicable. There is no need to bring on labour or to take special pains to accelerate it. If the nervous erethism can be controlled and the kidneys and skin made to act, Nature will deliver the patient sooner or later. If the convulsions come on before labour, Dr. Love controls them and lets the uterus and its contents entirely alone.

Dr. Newton concurs with Dr. Love in asserting that there is no use whatever in emptying the womb; the procedure, he says, adds infinitely to the woman's danger and does not strike at the root of the evil. The convulsions may be a concomitant of labour or they may occur long before, and in some cases have appeared a number of days after delivery. They generally occur at the time of labour because the poisoned and weakened nervous system is called upon for a great expenditure of force, and it is bad practice to increase the strain upon the vital powers of a human being already almost *in extremis*.

It is generally admitted, says Dr. Newton, that pregnancy is a serious complication of the acute infectious diseases, like diphtheria or typhoid fever. Yet no one has suggested that this element of danger can be removed by bringing on labour. On the contrary, if labour does come on the case at once assumes a more serious aspect, and so the indication is to do all in our power to prevent the advent of labour. It may be said that, inasmuch as the strain of labour brings on the convulsions, if the labour can be concluded the exciting cause of the eclampsia will be removed. This is unquestionably true. But the acceleration of labour adds immeasurably to the risk, whereas its retardation will give the economy more time, with the aid of proper remedies, to put itself in a condition to safely undergo the strain of delivery.

At a meeting of the Society of Alumni of Bellevue Hospital held on October 2, 1895 (*New York Medical Journal*, November 23, 1895), Dr. Charles Clifford Barrows reported

two cases of puerperal convulsions in which he had employed veratrum viride—in one case in conjunction with Dührssen's incisions of the cervix uteri, and in the other with *accouchement forcé*. Each of the patients had had several convulsive seizures after the uterus had been emptied. The delivery in each case had not been followed by any urinary secretion until after the administration of the veratrum, when it had become very copious, and the patient had immediately begun to improve. Dr. Barrows mentioned another case of eclampsia occurring six hours after delivery, with total suppression of urine. The usual remedies, including the free use of nitroglycerin, had been tried without success, and the patient had seemed in a fair way to die at the time he had first seen her. Under the hypodermic use of veratrum, however, the kidneys had begun to act at once, and the patient had shortly become conscious, there had been no more convulsions, and she had made an excellent recovery.

In the discussion which followed (which called forth Dr. Newton's letter, already referred to) Dr. J. Clifton Edgar said he did not believe any drug, except possibly chloroform, was of as much value as veratrum viride in eclampsia. He had not dared to use it in cases in which the pulse was intermittent or soft, but he had employed it freely in those where the pulse had been tense and rapid. The action of the veratrum viride on the skin should not be overlooked. This was almost as prompt as its action upon the heart and kidneys, and by the free excretion through the skin the kidneys were greatly relieved. This, in his opinion, was much better than exciting the skin to action by using the hot-air bath. Dr. Mann had cited before the American Gynæcological Society a case in which a teaspoonful of the plain tincture of veratrum viride had been given by mistake, and yet the woman had survived. Dr. Edgar said he recalled a case in which he firmly believed the life of the patient had been saved solely by the veratrum viride. The plain tincture had been given hypodermically in 10-minim doses until the pulse had been reduced to sixty, and this had been continued until the pulse had shown a disposition to remain at this point without the help of the drug.

Dr. W. J. Chandler, of South Orange, New Jersey, said that the use of veratrum viride in cases of puerperal convulsions had many years ago been a common treatment in the Orange Memorial Hospital. At one time a brother practitioner had told him that he was treating cases of puerperal eclampsia with teaspoonful doses of Norwood's tincture, and that all the patients recovered. This physician had also said that he was not at all afraid of this heroic treatment, because if the patient received too much of the drug it would at once be rejected by the stomach. Influenced by this statement, Dr. Chandler had decided to try the method. In 1879 he had been called to see a woman who had had convulsions before delivery. When he first saw her, after delivery, the convulsions were present, and she was somewhat maniacal. As she was unable to swallow, 25 minims of Norwood's tincture were given hypodermically. About an hour afterward he was hastily summoned to the bedside, and found the respirations reduced to four and the pulse to forty. As the drug had been given subcutaneously, of course no relief could be expected from vomiting, as was usually the case. Under stimulation and appropriate treatment the woman eventually recovered. In this case the excretion of urine had been increased, and the skin had been bathed in perspiration. This action of the drug he had noticed in all these cases. Since this time he had often used the drug very freely by the mouth, but he would warn against using it hypodermically.

Dr. F. K. Willis, of Watkins, Kansas (*Medical News*, March 28, 1896), records his favourable experience in the treatment of puerperal convulsions with veratrum viride. He says it not only arrests convulsions, but in several cases in his hands it has prevented them when threatened. No patient, he says, has suffered eclamptic convulsions who came to him complaining of headache and nervousness and presenting some œdema, a full, hard pulse, etc. In this class of cases, 5 minims of the fluid extract should be given two or three times daily, according to the urgency of the case. When paroxysms occur, he always administers hypodermically 15 minims at once, and in half an hour 5 minims more if necessary. It may be necessary to continue the administration for twenty-four hours or longer to prevent recurrence. Generally speaking, the pulse should be held at 50 or 60 for a day or two.

In conjunction with gelsemium, veratrum viride has been used with success in the treatment of *traumatic tetanus* by Dr. Fordyce Grinnell, of Pasadena, California (*Medical News*, July 18, 1896). The case was that of a boy, six years old, who, while barefoot, cut the ball of his left foot on a piece of glass. The wound apparently healed. Some nine days after (on April 14th) he complained of stiff jaws and difficulty in swallowing. These symptoms increased until, on the night of the 16th, tetanic spasms began to manifest themselves. The cicatrix of the wound was cleaned and scraped. It seemed somewhat tender on pressure, but no foreign body was discovered. The site was scarified, however, and turpentine and oil were applied, and 4-grain doses of ammonium bromide were given every two hours.

As no perceptible improvement was noted, on the 17th Norwood's tincture of veratrum viride was given, at first a drop every hour, then 2 drops every hour. As this did not seem to prevent the return of the spasms from time to time, fluid extract of gelsemium was given, at first in drop doses every hour, in conjunction with the veratrum, then in 2-drop doses, and finally in 3-drop doses. The dose of veratrum was also increased on the 20th to 3 drops every hour, so that the child was taking 3 drops each of the veratrum viride and the gelsemium every hour, and it seemed to require this amount to control the spasms. These doses were continued for forty-eight hours. Only once during this time did they produce

active vomiting or sufficient nausea to require an opiate to control it. When this relaxed condition was obtained, the drops were decreased to 2 of each preparation on the 22d, and on the 25th to 1 of each, which was continued until the 27th, when the interval was lengthened to two hours, and gradually thereafter the doses were discontinued.

The ammonium bromide was given in 3- to 4-grain doses every two hours during this entire period. The use of the remedies in diminished doses was continued to the 30th of April, when the boy could open his mouth without difficulty, had a good appetite, and was playful, but more boisterous in his manner than usual, or, as his mother said, "more nervous." The instructions had been to decrease the amount and frequency of the doses when distinct signs of nausea appeared or the signs of convulsions abated. Dr. Grinnell says that he was led to try veratrum on account of its value in puerperal and other convulsions, and gelsemium by reason of its action in causing relaxation of the muscles of the jaw.]

MATTHIAS LANCKTON FOSTER.

VERBASCUM.—Several species of mullein have been used in medicine, but chiefly the *Verbascum Thapsus*. Under the name of *flores verbasci*, the Ger. Ph. recognises the flowers of *Verbascum phlomoides* and *Verbascum thapsiforme*. A decoction made in the proportion of an ounce of the flowers to a pint of water may be taken in doses of from 3 to 5 fl. oz. as a *demulcent* and *astringent* in *diarrhœa*. The leaves are occasionally smoked to allay the paroxysms of *asthma*.

VERDIGRIS.—See *Cupric acetate* (vol. i, page 303).

VERNONIA.—Several species of this genus, the iron-weed, have been used to some extent in medicine. *Vernonia anthelminthica* is the oil-plant, or kinka, or khatzum, of the East Indies. The bitter seeds are used as a *stomachic*, and the fat obtained from them is said to be a powerful *anthelminthic*. *Vernonia nigritiana*, a species found in western Africa, is said to act upon the heart like digitalis, but more feebly. Vernonia has not come sufficiently into use to justify positive statements as to its medicinal value.

VESICANTS, VESICATORIES.—See BLISTERS.

VIBURNUM OPULUS (U. S. Ph.).—This caprifoliaceous plant, known as cramp bark, is a large shrub which is found throughout the north temperate zone. It grows on low grounds.

The bark, which is the part used in medicine, is tough and has a bitter and slightly astringent taste. It contains a volatile oil, tannin, an acid, and a bitter principle, viburnin.

Cramp bark has been recommended as an *antispasmodic* in *asthma*, and has been used in *hysteria* and in *puerperal* and other forms of *convulsions*. It has also been employed in the treatment of *neuralgia* and *dysmenorrhœa*. Its medicinal value has not been established, and it is now but little used in medicine. The principal preparation is the fluid extract, *extractum viburni opuli fluidum* (U. S. Ph.), the dose of which is from 15 minims to a fl. drachm. The berries of viburnum opulus are *antiscorbutic*.—CHARLES JEWETT.

VIBURNUM PRUNIFOLIUM (U. S. Ph.), or black haw, is a tall shrub indigenous to the middle and southern portions of the United States east of the Mississippi River. Closely allied to it are the *Viburnum obovatum* of the Southern United States and the *Viburnum Lantana* of Europe. The bark, which is the part used in medicine, has a bitter, astringent taste, but no odour. It contains valerianic, tannic, oxalic, citric, and malic acids, a brownish resinous principle, and a greenish-yellow resin, *viburnin*.

Viburnum prunifolium is an *astringent*, *diuretic*, *nervine*, and *antispasmodic*. In the lower animals, toxic doses cause progressive muscular weakness and finally paralysis. In warm-blooded animals it is a vaso-motor relaxant, lowering the arterial pressure.

Viburnum prunifolium is much employed as a *uterine sedative*. It appears to inhibit *uterine contractions* and to diminish *hyperæmia of the pelvic organs*. It is useful therefore in the prophylaxis of *abortion*, for the palliative treatment of *dysmenorrhœa*, especially of the spasmodic variety, and in *menorrhagia* and *metrorrhagia*. While less effective than opium for the control of uterine expulsive efforts, it has the advantage of freedom from the unpleasant after-effects of the latter drug. It is a remedy of some value for the relief of *after-pains*. In dysmenorrhœal and in certain forms of *intermenstrual pain* it is frequently combined with Jamaica dogwood or with cannabis indica; in *menorrhagia*, with golden seal.

[Dr. Theodore Shennan (*Edinburgh Medical Journal*, November, 1876; *New York Medical Journal*, November 21, 1896) says that Dr. Phares, of Newtonia, Mississippi, has the credit of initiating the use of *viburnum prunifolium*. His paper, published in 1866, recommended it as *astringent*, *diuretic*, *tonic*, and *antispasmodic*, but chiefly as a remedy for *dysmenorrhœa* and as a *preventive of abortion*. Little more was heard of it until 1876, when Dr. Jenks, of Detroit, revived its use. He employed it in *menorrhagia*, *metrorrhagia*, and *dysmenorrhœa with menorrhagia*. He attributed a great deal of its value to the presence of a body similar to valerianic acid.

Rockwell, in 1879, used it in dysmenorrhœa. He considered it was indicated in delicate, nervous women in whom pain was due to slight anteflexion, slight endotrachelitis, or partial stenosis, or where it was neuralgic in character. He classed it as anodyne, antispasmodic and tonic. The last term is very indefinite, Dr. Shennan thinks, though in one of his cases he noticed a relief of nausea or sickness which followed the administration of viburnum.

Abbot, in 1879, used it in dysmenorrhœa with great success, as also Curtis (1879) and Lyman.

Chadwick, in 1879, found it gave relief in many cases, but success was not invariable, or so brilliant as previous papers had led him to expect. Its action was similar but not superior to that of zinc valerianate.

Dr. R. L. Payne read a paper on *Viburnum prunifolium* before the Medical Society of North Carolina in 1888. This, says Dr. Shennan, is one of the few papers which treat the subject scientifically, and describe experiments carried out on the lower animals. Dr. Payne refers to the literature of viburnum, and the want of definite rules for its use. He experimented with the ordinary alcoholic liquid extract; or with the solid extract rubbed up with water, with the view of getting rid of the vitiating effects of the alcohol contained in the fluid extract. He found that both had a similar effect. His results were as follows: Paralysis and loss of reflex motion, both with mechanical and with chemical stimuli. He got reactions with electrical stimuli—whether faradaic or galvanic is not stated—one pole to the spine, the other to the limb. He gave as much as half an ounce of the fluid extract to rabbits, and the amount of alcohol contained must undoubtedly have had an effect on the tracing. Dr. Shennan thinks that his experiments on rabbits prove this. In rabbits (the solid extract being used, rubbed up with water) the blood-pressure was found to fall very rapidly after the injection of a syringeful into the jugular vein. Here, Dr. Shennan thinks, evidently no care had been taken to make the fluid neutral or slightly alkaline, and the resins, which are present in considerable quantity, were not removed before injection. Dr. Payne's tracings show a marked effect on the blood-pressure, but at parts suggest, by the weakness of the heart curves, that there may have been some clotting in the cannulæ. There was evidently no balancing of pressure in the vessels by use of a column of mercury, and, as the blood was thus allowed to pass for some distance into the tube leading to the recording apparatus, the tendency was for it to clot. Dr. Shennan states that he has found this clotting to be very troublesome in his own experiments.

Dr. Payne concluded that there was no effect on sensibility. The chief action was on motion, paralysis, loss of voluntary motion, loss of reflex power, the extent being governed entirely by the amount of the drug used. The pupils contracted in cold-blooded animals and did not change in warm-blooded animals. Muscular irritability was lost after lethal doses, but nerve conduction was lost before muscular contractility. Probably the action was chiefly on the spinal cord and its posterior columns. The heart was quick and feeble in its action, and the blood-pressure lowered; in lethal doses the heart stopped before respiration.

Dr. Payne recommended the use of viburnum in diseases with increased excitability of the motor centres—in *hysteria*, in *hystero-epilepsy*, in *petit mal*, in *paralysis agitans*, and in the *dysmenorrhœa* sometimes designated as *ovarian* or *spasmodic*. He asserted that it was harmful in menorrhagia due to congestion of the portal circulation, subinvolution of the uterus, metritis, erosions of the cervix, and fibroid tumours. It was preventive of abortion and very useful in habitual abortion. It had a paralyzing action on the uterus.

Dr. J. Hinton, of Detroit, in 1889, applied it for the control of false pains, and even of labour pains. He has never observed post-partum hæmorrhage or severe after-pains when using this drug.

Joseph, of Landeck, in Silesia, recommends viburnum very strongly in *virginal dysmenorrhœa*. He used it in two cases of habitual abortion, in which he was unsuccessful; but he does not consider this a sufficient trial. Of the forms of *dysmenorrhœa*, according to Joseph, that is most relieved which is brought about by mechanical obstruction—for example, congenital or acquired anteflexion, as opposed to congestive dysmenorrhœa, which is more common in married women. The amount of the flux was diminished, and sank to normal; moreover, the remedy changed the interrupted course to one more continuous. He recommends it as an *antispasmodic*, and not only in uterine or intestinal colic, but also in other conditions of *cramp*, such as that of voluntary muscles.

Dr. Boal prefers viburnum to opium in many cases, as it is more easily borne and is readily retained by the stomach. It is very beneficial in spasmodic dysmenorrhœa, and gives relief when dysmenorrhœa is due to flexion or to stenosis. It relieves pain preceding and during menstruation. Even if this one action was proved, says the author, and it was able to take the place of opium or alcohol, viburnum would be very serviceable.

Blackerby used it in habitual abortion, and cites a very conclusive case. A patient of his had had six abortions. Viburnum was administered during the seventh pregnancy, which went to term and ended in the birth of a living child. The eighth pregnancy had a similar result under the same treatment. Many other cases, says Dr. Shennan, have been related in which relief was obtained in threatening abortion after overexertion.

In regard to the indications for the use of this drug, says Dr. Shennan, they are as follows: 1. In *habitual abortion*, where this is not caused by syphilitic infection or by fatty placenta, good results undoubtedly seem to follow its use. 2. In *threatening abortion*, however caused, and at any period of gestation, if the patient is treated soon enough, it seems to be very efficient. 3. In *dysmenorrhœa*, if functional, spasmodic, or ovarian, or attended with menorrhagia, it often cures. If there is flexion or stenosis, it gives great relief, though, of course, it can not cure. 4. In the menorrhagias and metrorrhagias of the *menopause* and in the *nervous disorders* of that time it is very beneficial. 5. *After-pains* are so readily relieved by it that some, like Auvard, consider that its use is dangerous unless all clots are cleared out of the uterus previously. 6. It may be used in the diagnosis of *false pains*, as it speedily relieves them. 7. It is also used with success in *colicky diarrhœa* and in *dysentery*.

Some even maintain that it has a curative effect on *cramps of voluntary muscles.*

Concerning the physiological effects on animals and man, Dr. Shennan has undertaken some experiments, from the results of which he draws the following conclusions: In mammals, warm-blooded animals, owing to the difficulty of giving a large enough dose hypodermically, there is no marked effect, except drowsiness and some lessening of motor power. If the substance is introduced into the heart directly, there is rapid lowering of blood-pressure to about half the normal, with slow return to near the normal as the drug is eliminated.

Although too much reliance must not be placed on experimental results in cold-blooded animals as applicable to warm-blooded animals, including man, we may be allowed, he says, to take something from these results and use them as probably applicable.

Thus, there are probably some diminution of reflex irritability, a quieting effect on involuntary muscle, and possibly some lowering of blood-pressure, which, even though small, might afford relief in congested conditions. Then, and very important, there is the effect of the valerianic or viburnic acid in neurotic and hysterical conditions.

In the *Pharmacopœia* there are many drugs capable of bringing about all these desired effects. Why, then, he asks, use *Viburnum prunifolium?* Opium is one of our sheet-anchors, but then there are dangers and inconveniences attending its use. The patient may acquire the opium habit, the constipation caused by it is very troublesome, and it is very toxic. Viburnum has similar good effects, though not so strong. It is a good form in which to administer valerianic acid. Its effect upon unstriped muscle, though not so strong as that of opium, gives the relief necessary. It has scarcely any effect in causing constipation.

Toxic effects have been noticed only with very considerable doses. Herrick has seen disturbance of vision, dryness of the mouth, and headaches; and Wilson has observed similar conditions, but these were with doses larger than are usually administered to man.]

The dose of the fluid extract, *extractum viburni prunifolii* (U. S. Ph.), is from ½ to 2 fl. drachms. The solid extract, which is not official, does not appear to fully represent the drug, but in pill form it has the advantage of being less unpleasant than the former preparation. The extract may be given in doses of from 3 to 10 grains.—CHARLES JEWETT.

VICHY is the most famous of the French spas. It is situated in the Department of the Allier. It is one of the most universally frequented resorts in Europe, twenty thousand people being accommodated each season. The season extends from early in May to late in October. The springs are numerous, and the waters are used both externally and internally. The temperature of the springs varies from 57° to 178° F. The most important springs are three in number, the Grande Grille, the Célestins, and the Hôpital. In the second group are the Lucas, the Source du Parc, the Source Lardy, the Puits-Caire, and the De Mesdames. The water from these springs is exported very largely. Artificial Vichy water is much used, and is made after a chemical formula which is supposed to represent the composition of the water of the springs. The following table, showing the composition of the more important springs, is that given by Cyr:

	Grande Grille.	Célestins.	Hôpital.
Sodium bicarbonate	4·883	5·103	5·029
Potassium bicarbonate	0·352	0·315	0·440
Magnesium bicarbonate	0·303	0·328	0·200
Strontium bicarbonate	0·003	0·005	0·005
Calcium bicarbonate	0·434	0·462	0·570
Ferrous bicarbonate	0·004	0·004	0·004
Manganous bicarbonate	trace	trace	trace
Sodium sulphate	0·291	0·291	0·291
Sodium phosphate	0·130	0·091	0·046
Sodium arsenate	0·002	0·002	0·002
Sodium borate	trace	trace	trace
Sodium chloride	0·534	0·534	0·518
Silica	0·070	0·060	0·050
Total solids	7·006	7·195	7·155

The chief ingredients of Vichy water are, therefore, the bicarbonates of sodium and of calcium and the sulphate, chloride, and phosphate of sodium. It is abundantly charged with carbonic acid. It is properly classed as an alkaline water.

Vichy water is largely prescribed for *rheumatism, gout, dyspepsia, lithæmia, cystitis,* and *diseases of the liver.* Mild but persistent forms of *enteritis* and *gastritis* are especially benefited by a course of Vichy water. Patients with *diabetes* also improve under its use in some instances. The most positive statements are made as to its efficacy in *icterus* and recurring attacks of *hepatic colic.* It is a most valuable adjuvant in the treatment of diseases of the gouty and rheumatic group, but many of the favourable results are undoubtedly due to the large amount of water ingested.

FLOYD M. CRANDALL.

VIEIRIC ACID, VIEIRIN.—This is a white, amorphous bitter principle obtained from the bark of *Remijia Vellozii,* a cinchonaceous shrub found in Brazil. It is soluble in alcohol and in chloroform. It has been recommended as a substitute for quinine as a *tonic* and in the treatment of *malarial fevers.* It may be given in doses of from 1 to 4 grains.

VINCA.—Two species of this genus of apocynaceous plants, *Vinca major* and *Vinca minor,* the large and the small periwinkle, have been used to some extent in medicine. They are mildly *purgative, diuretic,* and *diaphoretic.*

VINEGAR, *acetum* (Br. Ph.), owes its properties to the presence of acetic acid, the proportion of which varies from 4 to 6 per cent. It may be dark brown in colour or clear and transparent, the former indicating its preparation from infusion of malt, a dark-coloured wine, or cider, and the latter that white wine has been its source. The variety most commonly employed in the household in the United States is that prepared from cider,

which is allowed to stand, except during cold weather, in the open air in casks, in each head of which is a small hole to allow the circulation of air and with a bottle inserted into the bunghole with the view of permitting the entrance of light and at the same time preventing the entrance of insects. It usually requires two summers to complete the process, at the end of which the vinegar should be of a clear brown colour and a slight flavour somewhat resembling that of apples, and should also be free of any woody taste. It is usual to rack off the clear part into a clean cask or, what is better, into glass or earthen receptacles, as, if it is allowed to remain, gelatinous masses consisting of the mycoderms of acetous fermentation are formed, which under some conditions may fill the casks. This substance is popularly known as the "mother of vinegar." In small amounts it will cause the acetification of almost any saccharine solution, and in many cases when it is found in partially emptied vinegar casks it is customary to add a solution of sugar and water. In this way a fairly satisfactory vinegar is made, but it lacks the peculiar taste and odour of that made from cider alone. The other varieties of vinegar are made by allowing malt infusions, wines, or solutions of alcohol to trickle over or through pine or beech shavings. By this measure they are exposed in thin layers to the action of the air, and oxidization of the alcohol into acetic acid is accomplished. When a white wine is employed the product is known as white vinegar, while that from malt is dark. The white variety is usually the cheapest and is the variety oftenest employed in the commercial preparation of condiments and in the household where there is a real or fancied objection to the coloured. There is no difference, however, in the effects of the different varieties, and a selection is usually dictated by taste or convenience.

Sulphuric acid is the commonest adulterant of vinegar, but, provided it does not exceed one part in a thousand, is without much effect. Lead is occasionally found, but rarely in sufficient amounts to be of any great importance. Mustard and red or black pepper are sometimes used to add to the pungency of vinegar which contains less than the proper amount of acetic acid.

As ordinarily employed as a condiment, vinegar is reasonably free from objection, but in undue amounts is apt to cause indigestion and act as an irritant of the alimentary canal. It enjoys some reputation among the laity as an agent for the reduction of corpulency, but in sufficient quantities to have the desired effect is entirely unsafe. Sponging with solutions containing 10 per cent. of vinegar is very grateful in all *febrile conditions* and after severe exercise.

For such purposes aromatic vinegar, which consists of acetic acid, water, alcohol, and a number of the essential oils, is much more agreeable, but is rather too costly for general use.

If the stronger acids are not available, vinegar may be employed as an antidote in *poisoning with alkalies*. Vinegars, the *aceta* of the pharmacopœias, are solutions of various drugs in vinegar or acetic acid, more particularly the latter. They were formerly employed to a considerable extent, but are not now extensively used on account of their ready decomposition.

[Carleton (cited in the *Canadian Practitioner* for May, 1896) states that vinegar is useful in *carbolic-acid poisoning*. When it is applied to the skin or to a mucous membrane which has been burned by the acid, it causes a rapid disappearance of the characteristic whiteness, as well as of the anæsthesia produced by carbolic acid, and it also prevents the formation of a slough. Moreover, it neutralizes any of the acid that may have been introduced into the stomach. The first thing, therefore, to do, he says, in cases where carbolic acid has been swallowed is to make the patient drink some vinegar mixed with equal parts of water, and then to wash out the stomach.

M. Lewin (*Revue de chirurgie*, September, 1895; *New York Medical Journal*, October 26, 1895) has employed vinegar to prevent *vomiting after chloroform anæsthesia* in a hundred and seventy-four cases. In a hundred and twenty-five cases, he says, he has obtained complete success, no vomiting of any kind having been produced. In forty-nine cases there was vomiting, but it was generally slight and the rejected material was rather viscous. The method should be very carefully carried out, he says, in order to insure good results. It is known, he remarks, that chloroform is eliminated almost exclusively through the lungs, partly as free chloroform and partly as formic acid and chlorine. It is evident, he says, that the chlorine exercises an irritating action on the larynx and on the trachea, and that this is one of the principal causes of the vomiting. When a cloth saturated with vinegar is held over the nostrils, the chlorine combines with the acetic acid as fast as it is evolved, and forms trichloracetic acid.

It is very dangerous to use pure chloroform, says M. Lewin, and all medicinal chloroform should contain a certain quantity of alcohol, which renders its decomposition during narcosis more difficult. It is also known, he continues, that chloroform dehydrates the tissues, and consequently after the action of the chloroform has been suspended it is well to make the patient breathe in air that is as humid as possible. This dehydrating action, he says, influences also the endothelium of the blood-vessels and causes coagulation of the blood, to which the slackening of the circulatory movement and the feeble activity of the chemico-biological phenomena in the capillaries also contribute. Under such circumstances, he thinks, acetic acid is a powerful agent in restoring to the blood its normal fluidity, owing to a property that it derives from the water it contains, and to its energetic power of destroying the fibrin. Moreover, acids in general are stimulants of the respiratory tract. The foregoing considerations, he says, seem to him sufficient to explain the phenomena without bringing forward a hypothetical action of the

vinegar, or of acids in general, on the vomiting centre by the intervention of the vasomotor nerves.

The following observations were made in cases where this treatment was employed by M. Lewin: Immediately after the application of the vinegar the pulse became strong, respiration grew deeper, the face regained a little colour, and the corneal conjunctiva became bright. The appetite returned at the end of a short time, and the patients occasionally complained of hunger on the very day of the operation. Frequently they did not suffer at all from the general uneasiness which nearly always follows chloroform anæsthesia. It does not follow from this, says M. Lewin, that the application of the vinegar always suppresses the vomiting, for, in some cases where the patients are very nervous or are suffering from certain affections of the lungs or of the stomach, vomiting may occur in spite of the treatment.

The method of application is as follows: A piece of linen of about the size of a napkin is saturated with vinegar and lightly wrung out; it is then placed on the patient's face, over the mask, which is afterward carefully withdrawn, care being taken not to allow the air to gain access to the face too suddenly, for it ought to pass through the linen cloth before being inhaled. This cloth must be kept on as long as possible, for three hours at the least, and it is better for the patient if the application is prolonged during the entire day, for occasionally the presence of chloroform in the expired air has been observed for more than two days after narcosis. If the cloth is removed too soon, nausea will set in. If the linen cloth dries very rapidly, it must be replaced immediately with a fresh one, which is put over the first cloth before the latter is drawn away, in order to prevent the air from touching the face. If the wet cloth is annoying to the patient, it may be held away from the face with a mask. It is of the greatest importance to conform to these rules, says M. Lewin, for failure to observe them has prevented good results from following the application of the vinegar.]—Russell H. Nevins.

VINUM.—See Wine.

VIOLA TRICOLOR.—This plant is the pansy, or heart's-ease, a flowering herb of the natural order *Violaceæ*, a native of Europe, extensively cultivated in flower gardens in this country and naturalized from Kentucky southward. Its medicinal properties depend chiefly on an *emetico-cathartic* active principle known as *violine*, on *viola-quercitrin*, and on salicylic acid.

Violine is a white alkaloid, soluble in alcohol, very sparingly soluble in water, which readily unites with various acids to form salts. In the plant it is found in the form of the malate and can be extracted in a pure state only by means of a complicated process. It is allied to emetine, the alkaloid of ipecacuanha, but is distinctly different.

Viola-quercitrin is a glucoside which crystallizes in the form of fine yellow needles and is decomposed when boiled with a dilute acid into quercitrin and a fermentable glucose. This substance was discovered by Mandelin, who also detected the presence of salicylic acid in several species of *Viola*.

The physiological action of *Viola tricolor* can hardly be distinguished from that of the other species of *Viola*, nearly if not quite all of which are possessed of similar properties, and very little has been written on the subject of the physiological action of the violets. But that little seems to show a noticeable resemblance in their action to that of salicylic acid. Large doses are said to cause headache associated with a feeling of confusion and dulness in the head and a sensation of heat over the entire body, together with stimulation and irritation of the skin, the genito-urinary tract, and the salivary glands, as shown by cutaneous eruptions with intense itching and profuse perspiration, frequent and profuse micturition of foul-smelling, turbid urine, with tenesmus of the bladder, and a profuse secretion of saliva. In smaller doses the decoction forms a mucilaginous, emollient, and slightly laxative drink.

Viola tricolor was first introduced into medicine as a remedy for *crusta lactea*, or *infantile eczema of the head and face*, sometimes known as "cradle cap." For this purpose it was given in the form of a decoction of the fresh herb in milk, while a poultice of the leaves was applied locally. Gradually this remedy fell into disuse, except in France, where it continued to be employed, and lately its use has been advocated by Dr. Piffard, of New York, as efficacious in cases of *eczema*. Instead of a decoction, he uses a fluid extract and gives quite full directions as to its employment. The drug should be given in the second stage of the disease, when a serous or sero-purulent exudation or crusting is present. In acute eczema full doses induce aggravation and extension of the eruption, with increased local heat and itching which last for several days. In order to avoid these disagreeable symptoms, he advises that only from 1 to 5 drops be given once or twice a day to a young child at the beginning of treatment. This dose may be increased if neither improvement nor aggravation occurs after a few days of treatment, while if the trouble is aggravated the use of the drug should be stopped and resumed in a few days with a smaller dose. In subacute and chronic eczema initial doses of from 10 drops to 2 fl. drachms are recommended, in a small quantity of water, about half an hour before meals.

The syrup of violets is prepared as an agreeable and palatable vehicle for other medicines, and has been used in *bronchial affections*, as a *demulcent drink*, and as a *laxative for infants*. It may also be used as a test for the presence of acids and alkalies, as the former turn the pale-violet colour of the syrup into red, and the latter turn it into green.

The *Viola cucullata*, or common wild blue violet of America, enjoys a local reputation in Pennsylvania as an antidote to the venom of the *rattlesnake*. It is given internally in the form of the fresh, raw leaves or that of a de-

coction, while a poultice of salt and indigo is applied to the wound.

MATTHIAS LANCKTON FOSTER.

VIOLETS.—See under VIOLA TRICOLOR.

VIRGINIA SNAKEROOT.—See SERPENTARIA.

VIROL.—This seems to be an English proprietary preparation of bone-marrow, intended originally as a palatable substitute for cod-liver oil, but afterwards recommended as a fatty food for infants and young children. (*Indian Lancet*, August 16, 1896.)

VIRUSES.—See under ANIMAL EXTRACTS AND JUICES (vol. i, page 82) and TOXINES.

VISCUM ALBUM, the mistletoe, is a European parasitic shrub which grows chiefly on deciduous trees, notably fruit trees. It forms a pendent evergreen bush several feet in diameter. The American mistletoe, *Viscum flavescens* (*Phoradendron flavescens*), is similar in medicinal properties to the European species. In addition to mucilage, tannin, resin, and a fixed oil, mistletoe contains a peculiar thick, viscid, and tenacious substance known as bird-lime or bird-glue. The latter ingredient may be obtained from the freshly bruised mistletoe bark by kneading it in water. Pawlevsky extracted from mistletoe a crystallizable acid nearly insoluble in water and quite so in alcohol and in ether. The fresh bark and leaves emit a peculiar unpleasant odour, and to the taste are slightly acid, bitter, and somewhat nauseous.

Mistletoe seems to act upon the heart like digitalis. It also excites vigorous *contractions of the uterine muscular fibres*, especially during labour. The uterine contractions, unlike those of ergot, are not tonic but clonic. As an *oxytocic*, however, mistletoe is less powerful than ergot. It has been employed in the treatment of *menorrhagia* and other varieties of *uterine hæmorrhage* and in *amenorrhœa*. It was formerly used to some extent as a *nervine*.

The dose as an oxytocic is from ½ to 1 fl. drachm of the fluid extract repeated every thirty to sixty minutes; as a uterine hæmostatic, a drachm may be given every four to six hours. A tincture and the decoction have also been employed. Taken in large quantities, the preparations of mistletoe produce vomiting and purging. A fatal case has been reported.

The drug is of little value in medicine and has practically fallen into disuse.

CHARLES JEWETT.

VITELLUS.—Yolk of egg. See EGGS.

VITIS IDÆA.—See VACCINIUM.

VITRIOL, BLUE.—See *Cupric sulphate*, under COPPER.

VITRIOL, GREEN.—See *Iron sulphate*, under IRON (vol. i, page 549).

VITRIOL, OIL OF.—See SULPHURIC ACID.

VITRIOL, WHITE.—See *Zinc sulphate*, under ZINC.

VULNERARIES.—These are substances which, applied to wounds, bruises, etc., are supposed to hasten the return of the injured parts to their natural condition. So far as open wounds are concerned, it is probable that all the vulneraries that are really efficient act as antiseptics or germicides; the effects of bruises are more or less amenable to the action of sorbefacients.

WAFERS.—These consist of thin, brittle sheets, square or circular, made by pouring a mixture of water and fine flour upon hot plates. For use, a suitable piece is dipped into cold water to make it pliable. It is then laid upon a tablespoon, the powder or other medicine placed in it, and the edges having been folded over, the closed wafer is swallowed. This method was formerly much in use, particularly in domestic practice in Europe, for administering nauseous medicines. Limousin, of Paris, some twenty years ago, brought this form of administering medicines again into vogue by the introduction of a very convenient apparatus and a special form of wafer. The latter, of which there were several sizes, are made of the shape of small concave cups with flat rims. One of these wafer-cups is laid in a corresponding cavity of a frame, the requisite amount of the substance is placed in the wafer, and another wafer-cup, the edges of which have just been moistened, is brought down over the former so that the edges of the two meet exactly, whereupon they are gently pressed together, thus causing the two wafers to cohere, enveloping the powder between them. Limousin's first apparatus has been somewhat improved upon, both by himself and by others, so that a number of wafers may be filled and closed in one operation. When a wafer capsule (as it may be called) is to be swallowed it should first be dipped in water so as to render it soft and flexible.

A very convenient substitute for the wafer is the Japanese usego paper, consisting of almost pure cellulose and having remarkable tenacity. The medicinal substance is enveloped in a small piece of the paper and rolled into a sort of lozenge or elongated bolus which is then dipped in water and swallowed. The paper wrapper is readily digested in the stomach with the medicine.—CHARLES RICE.

WAHOO.—See EUONYMUS.

WASHES.—See LOTIONS.

WATER.—The free use of pure water as a beverage is of great importance in therapeutics. It may even constitute the chief element of treatment in certain cases of disease. Dr. Hector Maillart, of Geneva (*Revue de médecine*, March, 1894), says that, as the result of his study of the subject, he feels convinced that the treatment of *typhoid fever* with copious drinks may be recognised as a definite method. In order that the treatment may be efficacious, the patient should drink at least from five to six quarts of water daily during the whole febrile period. There is no contra-indication to this treatment: feebleness of the heart, far from contra-indicating the drinks, may become a special indication for them. The results are

a progressive lowering of the fever, disappearance of the dryness of the tongue and mouth, and pronounced sedation of all the alarming nervous, circulatory, and renal phenomena. These results are due to the oxidation of toxines and refuse material, which are rendered soluble and eliminated. The oxidation is shown by the formation of great quantities of urea, and the elimination takes place by the skin and kidneys in the form of profuse sweating and abundant diuresis. This diuresis reestablishes the integrity of the renal filter, and that results in the rapid disappearance of albuminuria. This method of treatment has no notable influence on the course or the duration of the disease. No unpleasant consequences have been observed to result from the treatment, either during the fever, during convalescence, or after recovery. The treatment, which is very acceptable to the patient, is easily carried out, even in cases in which the nervous disturbances are very decided. See also under ANTIBLENNORRHAGICS (vol. i, page 105) and the articles on WATERS, MINERAL; HYDRIATICS, BATHS, and DOUCHES.

WATERS, MINERAL.—Mineral waters is the term used to designate natural waters which hold in solution different gaseous or mineral substances, the proportion of these latter constituents being such that the waters may be employed for medicinal purposes. Such waters may be administered internally as beverages, or externally in some of the various forms of baths.

An absolutely pure water cannot be obtained even by chemical processes. Almost all natural waters are impregnated with extraneous substances. Rain water contains organic matter, carbonic acid or other gases, and salts which it absorbs in falling through the atmosphere. Spring and artesian-well waters are likely to contain a certain amount of gases, such as carbonic-acid gas or sulphuretted hydrogen produced by the decomposition of organic matter in the soil, as well as a certain amount of the soluble salts dissolved from the strata between the origin and source of the flow; it is to be recalled that gases in the water will facilitate the solution of otherwise insoluble substances.

The constituents of mineral waters may be gaseous, inorganic, or organic. The following substances have been found in mineral waters:

GASEOUS.	Oxygen. Nitrogen. Carbonic oxide. Sulphuretted hydrogen. Methane. Air.
INORGANIC.	Ammonium crenate, nitrate, nitrite, and sulphate. Aluminum oxide, phosphate, silicate, and sulphate. Antimony teroxide. Arsenic, arsenious oxide. Barium bicarbonate, carbonate, and sulphate. Bromine. Cadmium sulphate. Calcium bicarbonate, bromide, chloride, crenate, carbonate, fluoride, phosphate, silicate, oxide, sulphate, and sulphide. Cobalt carbonate and sulphate. Copper carbonate and sulphate. Fluorine. Iodine. Iron bicarbonate, bisulphate, carbonate, crenate, oxide, phosphate, sesquichloride, sesquicarbonate, sesquioxide, sulphide, and sulphate. Lead carbonate and sulphate. Lithium carbonate, chloride, bicarbonate, and sulphate. Magnesium bicarbonate, borate, bromide, carbonate, and chloride. Manganese carbonate, bromide, iodide, oxide, and sulphate. Nickel bicarbonate, carbonate, and sulphate. Potassium bromide, chloride, nitrate, and sulphate. Phosphorus. Silica. Sodium biborate, bisulphide, bromide, bicarbonate, carbonate, chloride, iodide, metasilicate, hyposulphite, nitrate, phosphate, silicate, sulphate, and sulphide. Strontium bicarbonate, carbonate, and sulphate. Sulphur. Zinc bicarbonate, carbonate, and sulphate.
ACIDS, FREE OR COMBINED.	Boric. Hydrochloric. Hydrosulphuric. Nitric. Phosphoric. Silicic. Sulphuric.
ORGANIC.	Acetic acid. Butyric " Crenic " Formic " Propionic " Infusoria and vegetable matter.

An inspection of this list of active or inactive constituents of mineral waters will indicate the difficulty of classification. Various plans have been proposed for a suitable scheme in which to group these waters, based on their geographical distribution, their geological origin, their chemical constituents, their thermal characteristics, or their therapeutical action, each of which has had its advocates. As the physician is interested simply in their remedial properties, the most satisfactory method for his use is one that deals with the temperature and the chemical constituents of the water. The latter method has its disadvantages, however, as may be seen if we take, for example, Professor J. W. Mallet's analysis of the Rockbridge Alum Springs, in which some twenty-five constituents are found in the water. The effects of the oxygen, nitrogen, and carbon dioxide may be accounted for; the traces of organic matter, calcium fluoride, and cadmium sulphate may be ignored so far as any influence they are likely to exercise is concerned, and the preponderance of aluminum sulphate suggests that the water will possess the physiological properties of that salt. But with all there are definite quantities of the sulphates of sodium, calcium, lithium, magnesium, potassium, manganese, nickel, cobalt, copper, zinc, and iron, as well as of sulphuric acid, that combine to give this spring certain definite features, and that may have their physiological action, moderate though it may be. It is not possible in the case of the Carlsbad water to ignore the influence of the bicarbonate of sodium, which almost equals in quantity the sulphate of sodium.

There are waters that are known as chalybeate in which the percentage of iron is less than that of many of the other ingredients, yet their principal physiological effect is due to the iron salt. Other waters contain several active ingredients, the physiological effects of each being manifested when they are administered, so that they might be included in several classes.

The classification adopted by the better German authors on balneology has for its purpose the distinction in the therapeutic properties of the waters, though it is necessarily difficult to distinguish these properties, as, for example, between the alkaline and the alkaline-saline waters, or between the sulphuretted and the ferruginous waters. This arrangement includes:

- I. Alkaline waters.
  - 1. Simple alkaline waters.
  - 2. Alkaline chlorinated or muriated waters.
  - 3. Alkaline-saline waters.
- II. Saline or chlorinated waters.
- III. Sulphur waters.
- IV. Ferruginous waters.
- V. Earthy, or calcareous, waters.
- VI. Indifferent thermal waters

The alkaline waters are those that contain potash and soda; they are clear and colourless and have either little taste or a salty taste, according to the quantity of salt that they contain. The most important constituents of the simple alkaline waters are sodium carbonate and carbonic acid. When common salt is present in the alkaline water in decided quantity, it is called an alkaline chlorinated water. And if, in addition to the alkali, there is sodium or magnesium sulphate, the water is alkaline-saline. Alkaline carbonates, chlorides, and sulphates have respectively specific effects on the biliary, gastric, intestinal, and urinary secretions. For example, an alkaline carbonate increases the flow of bile, neutralizes the gastric juice, and renders the urine alkaline. The sulphates act more or less powerfully on the bowels, and increase the number of stools as well as the total amount of fæces voided in a given time.

The principal ingredient of the saline waters is sodium chloride. Such waters are clear and their taste depends upon the quantity of salt present; if it is below 2 per cent. the water is simply saline, but if there is a large quantity of salt the water is a brine that can only be used therapeutically as a bath. In some chlorinated waters there are definite proportions of salts of iodine or bromine, and these waters have been called iodine or bromine waters. A chloride acts chiefly in increasing the quantity of organic and inorganic substances eliminated by the kidneys.

Sulphur waters are those that contain sulphuretted hydrogen.

Ferruginous, or chalybeate, waters are those that contain definite quantities of some iron salt.

Earthy, or calcareous, waters are those in which calcium carbonate or sulphate and magnesia are the predominant chemical ingredients.

Indifferent thermal waters are those that contain an insignificant quantity of mineral constituents.

The French balneologists divided mineral waters into the following classes:

- I. Bicarbonated waters.
  - 1. Sodium bicarbonate.
  - 2. Calcium bicarbonate.
  - 3. Mixed bicarbonates.
- II. Chlorinated waters.
  - 1. Sodium chloride alone.
  - 2. Sodium chloride with bicarbonates.
  - 3. Sulphuretted.
- III. Sulphur waters.
  - Sulphuretted hydrogen with sodium salts.
  - Sulphuretted hydrogen with calcium salts.
- IV. Sulphated waters.
  - Sodium sulphate.
  - Calcium sulphate.
  - Magnesium sulphate.
  - Mixed sulphates.
- V. Ferruginous waters.
  - Bicarbonated.
  - Sulphated.
  - With manganese salts.

The disadvantage of such a chemical classification is apparent in the association of waters that contain salts which act so dissimilarly as in class IV, which includes waters that contain sodium sulphate and waters that contain calcium sulphate.

Mineral waters in this article will be considered as hot, or thermal, and as cold waters. These may be either simple, in the case of thermal waters and waters which contain very small percentages of mineral substances; gaseous, in consequence of the presence of carbon dioxide, or carburetted, or sulphuretted hydrogen; chlorinated, in which there is a predominance of sodium chloride; alkaline; saline, in which there is sufficient sodium or magnesium sulphate to produce the therapeutical effect of either of those salts; chalybeate, or ferruginous; and earthy, or calcareous.

In the simple thermal waters saline and gaseous constituents are present in such insignificant proportions that the efficacy of the water as a remedial agent is evidently due to the temperature, which may range from 85° to more than 110° F. The most familiar example of such water is that of the Hot Springs of Arkansas, the waters of which contain 8·55 grains of solids to the gallon, almost 4 grains of which is calcium carbonate; the temperature of the water varies from 93° to 157° F., and if taken internally it can only act, as is the case with other waters of this class, like simple hot water. Drinking the water from simple thermal mineral springs is a means of effecting gastric lavage; the secretion of saliva, gastric juice, bile, pancreatic juice, and urine is increased, with the consequent stimulation of metabolism and the excretion of effete products from the tissues. The warm water is more easily absorbed from the stomach than cold water is, because the temperature of the latter must be raised first to the temperature of the body; and such water gently promotes the peristaltic action of the bowels.

The use of warm and hot water in baths has been described elsewhere in this work. These thermal waters were called *nerve-baths* by Professor Romberg, because they lessened morbid irritability of the cutaneous nerves.

The internal administration of simple thermal water is more useful at resorts than at home, because the patients who visit them are

more careful in their attention to the details of the treatment, there is likely to be less infraction of the rules which are laid down for dietetic observance, more exercise is taken, and there are the associated advantages of change of air, of environment, and of mental impressions.

In prolonged and irritable phases of *chronic inflammation of the throat, the stomach*, or *the intestines*, resort to such a spring is likely to redound to the patient's advantage. In *chronic constipation* associated with deficiency of the hepatic or intestinal secretions, in *chronic rheumatism*, in *gout*, and in *neurasthenia*, this treatment will prove useful. The external and internal use of such waters will benefit *ulcers of the skin* and *gunshot wounds that suppurate chronically*. Old *cerebral, spinal*, and *peripheral paralyses* are often benefited, if only by the improved condition of the patient, while *paralysis of toxic origin*, especially that due to lead, is usually rapidly improved by the external and internal use of thermal waters. *Hysteria, insomnia, neurasthenia, neuralgia*, and *peripheral neuritis* may be treated beneficially by the combined use of such waters. The employment of these waters in the earlier stages of *Bright's disease*, in *catarrh of the pelvis of the kidney*, and in *cystic catarrh* will aid in preventing self-intoxication and be likely to favourably influence the affected tissues.

The accompanying list will show the situation of a number of thermal springs. There are many more such springs in which the waters contain a larger amount of solids; but it has seemed to the writer that this class should be limited to springs in which the water does not contain more than a drachm of solids in each gallon, and that to include waters containing several hundred grains of solids is to ignore the possible medicinal effect of some of the constituent substances. For some of the data contained in this table and in subsequent lists, the writer is indebted to Leichtenstern's article on Balneotherapeutics in von Ziemssen's *Handbook of General Therapeutics*.

SIMPLE THERMAL SPRINGS.

NAME.	Solids, per gallon.	Country or State.	Elevation, in feet.	Temperature of springs, Fahr.
Monroe Hot Spring, near Prescott	.....	Arizona.	5,316	150·0°–160·0°
Rio San Francisco Hot Springs	0·66	Arizona.	6,666	127·0°–130·0°
Hot Springs	8·55	Arkansas.	718	93·0°–157·0°
Agua Caliente, San Diego Co	39·3	California.	725	100·4°
Calistoga Hot Spring, Napa Co	37·50	California.	331	100·0°–195·0°
Hot Spring, Paoha Island, Mono Lake	0·29	California.	.....	110·0°
Mono Basin Warm Spring	2·08	California.	6,730	85·0°– 90·0°
Paso de Robles (sulphuretted), San Luis Obispo Co	8·07–17·53	California.	.....	112·0°–122·0°
Cañon City Hot Spring	0·40	Colorado.	5,442	104·0°
Bruneau Hot Springs, Owyhee Co	.....	Idaho.	.....	105·0°
Given's Hot Springs, Owyhee Co	.....	Idaho.	.....	98·0°
Emigrant Gulch Warm Springs, Gallatin Co	0·23	Montana.	4,296	102·0°
Helena Hot Spring, Helena	0·62	Montana.	4,150	122·0°–141·0°
Livingston Warm Springs	0·75	Montana.	4,485	104·0°
Matthew's Warm Springs	0·59	Montana.	.....	114·0°–122·0°
Hot Springs, Churchill Co	2·49	Nevada.	4,098	158·0°–187·0°
Ward's Hot Springs, Humboldt Co	1·19	Nevada.	.....	190·0°–200·0°
Jemes Hot Springs, Bernalillo Co	0·24	New Mexico.	.....	94·0°–168·0°
Warm Springs	33·87	North Carolina.	1,325	92·0°–117·0°
Hot Springs, Bath Co	0·59–33·36	Virginia.	.....	50·0°–110·0°
Gastein	11·35	Austria.	3,490	95·0°–138·4°
Johannisbad	0·75	Austria.	1,955	84·2°
Neuhaus (Styria)	1·03	Austria.	1,200	95·0°
Römerbad	0·75	Austria.	730	96·8°
Teplitz	2·32	Austria.	700	118·4°
Tüffer	0·75	Austria.	690	95·0°–102·2°
Tobelbad	1·95	Austria.	1,070	82·4°
Villach (Styria)	.....	Austria.	7,000	84·0°
Bath	7·14	England.	.....	107·6°–116·6°
Plombières (Vosges)	0·92	France.	1,400	66·0°–158·0°
Mont Dore (Auvergne)	5·96	France.	3,430	107·6°
Schlangenbad (Nassau)	1·01	Germany.	925	82·0°– 92·0°
Warmbrunn (Silesia)	1·65	Germany.	1,100	96·8°–107·6°
Wildbad (Black Forest)	2·08	Germany.	1,323	91·4°– 98·6°
Bormio	3·35	Italy.	4,825	100·4°
Leuk (Canton Wallis)	6·95	Switzerland.	4,356	92·0°–122·0°
Pfäffers (Canton St. Gallien)	1·01	Switzerland.	2,130	98·6°

Carbonated waters are those that contain carbonic acid, and that gas is usually associated with other chemical ingredients. Administered internally, carbonic acid is a stimulant to the mucous membrane of the stomach and intestines, probably in consequence of excitation of the motor nerves, although it has a sedative effect on the sensory nerves when administered in small quantities. It also causes increased secretion of urine. Large quantities of carbonated water have produced gastric distention, eructations, cardiac irritability, and pulmonary and cerebral hyperæmia. A larger quantity of carbonic acid is tolerated if the water is cold than if it is warm. In *gastric* and *intestinal atony* a simple carbonated water will frequently afford marked relief. In *nausea* such waters are applicable; and in the nausea associated with malarial and other fevers the free use of carbonated waters is indicated. Where a natural water is inaccessible,

the separate portions of a seidlitz powder may be dissolved in two glasses, and a tablespoonful of each solution given in succession; the small quantity of carbonic-acid gas evolved in the stomach is very agreeable to the patient. In certain forms of *vesical* or *prostatic irritability* the frequency of micturition is lessened by using these waters. [For the use of carbonated waters in the Schott treatment of chronic heart diseases, see BATHS (supplement)].

Chlorinated waters, which are also known as muriated or muriated saline waters, are those in which sodium chloride is the principal solid constituent, though it is frequently associated with other chlorine salts and gases. When the chlorinated waters contain iodine or bromine they are called iodine or bromine salt, or chlorinated, waters; if they contain such earthy salts as calcium or magnesium sulphate or carbonate they are termed earthy salt, or chlorinated, waters; if they contain sodium or magnesium sulphate they are known as saline chlorinated waters; if they are distinguished by the presence of a definite quantity of an iron salt they are called chalybeate chlorinated waters; and if there is a large volume of carbonic acid they are called acidulous chlorinated waters.

Sodium chloride plays an important part in the animal economy, and it forms the greater portion of the soluble constituents of the ash of all animal substances. The gastric juice is normally rich in sodium chloride, which is one of the sources of the hydrochloric acid in the stomach. It promotes digestion by facilitating the solution of albumin and casein, and plays an important rôle in furthering the processes of absorption and secretion, in consequence of its stimulating effect on the gastric and intestinal glands.

The experiments of Braun, Grützner, and Boas have shown that the addition of sodium chloride to the blood increases the secretion of gastric juice, and whatever quantity, in moderation, is in excess of the needs of the body is excreted chiefly by the kidneys. In moderate quantities it is quickly absorbed from the stomach, and Buchheim showed that within six hours it was excreted in the urine. As it is essential for the formation as well as the disintegration of cells, it stimulates not only the progressive, but also the retrogressive tissue changes of the animal organism. When a moderate quantity of sodium chloride is introduced into the stomach it stimulates the secretion of the gastric juice, and excites increased peristaltic action in that viscus, which favours the passage of the gastric contents into the intestinal canal. The peristaltic action of the intestines also is increased by the salt.

Bischoff, Kaupp, and Voit have proved that there is an increased excretion of urea after the administration of moderate quantities of sodium chloride. This is apparently due to the improvement in metabolism, the serum seeming to carry away albuminates, and favour their transformation into excretable products.

Externally, chlorinated waters in baths increase the excretion of urea and decrease that of uric acid and that of phosphates. There is an increased consumption of oxygen and there is increased excretion of carbonic acid. The skin is macerated and cleansed, its functions are stimulated in consequence of the action of the sodium chloride and the usually associated carbonic acid on the peripheral nerves. Such waters are more efficacious if warm than if cold. Various theoretical influences have been ascribed to the use of baths of such water, but more exact observations are needed to determine the entire scope of their therapeutic efficacy.

The action of the chlorinated waters is increased if either carbonic acid or sulphuretted-hydrogen gas is present. As water will take up its own volume of carbonic-acid gas under pressure, the amount of that gas in natural mineral water differs according to the proportion of that gas forced into the source whence the water comes; the gas effervesces when the water escapes from the spring, and unless the liquid is kept in firmly closed bottles it soon loses its natural gas. The carbonated waters are usually bright, sparkling liquids which possess an agreeable acidulous taste. These characteristics make such waters refreshing drinks in febrile and other diseases; the sensitive nerves of the stomach seem to be quieted by the influence of the gas, there is some stimulation of the peristaltic action of the stomach and intestines, and the action of the kidneys is increased.

The presence of hydrogen sulphide increases the palatability as well as the therapeutic usefulness of saline waters, as is shown by the Kentucky Blue Lick water, in which 516 of the 660 grains of solids in each gallon are sodium chloride.

When chlorinated waters are warm or hot they are more quickly absorbed, and thus may exercise an effect that is not obtained by the slow and imperfect absorption of cold water.

Boas observed the changes in the secretion of gastric juice during the administration of warm chlorinated waters, and noticed that after from three to four weeks of this treatment there was a decided improvement in the secretion of gastric juice and a coincident cessation of the symptoms in *chronic gastritis*. The chlorinated waters are indicated in all cases of *gastric catarrh* in which there is lessening of the secretion, either with or without the production of mucus. Such waters are useful for patients in whom there is a deficiency of the gastric and intestinal secretions. In *gouty* and *rheumatic conditions* the use of such waters, by improving metabolism, furthers the excretion of effete products, and if begun in time is likely to delay the degenerative changes incident to those affections. In some forms of *anæmia* in which there is rapid decrease in the proportion of red blood-corpuscles, marked improvement will follow the external and internal employment of thermal chlorinated waters. *Hepatic congestion* of a chronic type, with the associated aberration in the functions of the liver and the usually attendant *constipation*, is benefited by this treatment. In certain cases of *neurasthenia* in which there is self-intoxication these waters

will be useful and are to be preferred to the saline waters which contain the sodium and magnesium salts; the latter are slowly absorbed, are likely to cause gastric distress, and, by saturating the blood with neutral salts, which are improperly or slowly excreted, further involve the metabolic functions and thus contribute to do more injury to the nervous system. *Hypertrophy of the spleen*, due to paludism, may be reduced by the use of this class of waters in conjunction with other treatment. *Bronchial catarrh*, associated with *general asthenia*, is bettered, if not cured, by a course of chlorinated waters, internally and externally. The improvement in the general nutrition produced by such waters may explain the benefit that has followed their administration in *caries*, *necrosis*, and *rhachitis*.

The principal springs of this class are the following, though in this table the difficulty of classification has been encountered, because a number of the chlorinated waters are also sulphuretted and owe some of their properties to the presence of hydrogen sulphide:

NAME OF SPRING.	Situation.	Elevation, in feet.	Temperature.	Solids, in gallons.	Remarks.
Iola Mineral Well, Allen Co	Kansas.	955	61°	1,100·27	Carbonated; 980·5 gr. sodium chloride.
St. Clair Mineral Spring	Michigan.	.....	.....	628·37	405·53 gr. sodium chloride.
Ballston Spa, Saratoga Co.	New York.	310	49°–52°	247–1,233	Carbonated; ferruginous.
Excelsior Spring, Syracuse	New York.	403	48°	668·24	584·53 gr. sodium chloride.
Saratoga Springs, Saratoga	New York.	265	49°–51°	258–991	Carbonated; calcic.
Aurora Saline Springs, Marion Co.	Oregon.	218	57°	861·62	
Hall (near Steyer)	Austria.	1,064	.....	800·9	Carbonated; iodine and bromine.
Ischl	Austria.	1,574	.....		
St. Catharine's Wells, Ontario	Canada.	.....	60°	2,951·68	Calcic.
Bourbonne les Bains	France.	750	130°–150°	445·11	
Neuhaus, Bavaria	Germany.	1,200	95°	757·2	
Soden, Nassau	Germany.	440	86°	760	Carbonated.
Kreuznach, Valley of Nahe	Germany.	330	50°–85°		
Kissingen, Bavaria	Germany.	590	.....	55·8	Carbonated.
Nauheim, Wetterau	Germany.	450	89°–96°	.....	Carbonated.
Dürkheim, Bavaria	Germany.	377	55°–60°	.....	Carbonated.
Münster am Stein	Germany.	.....	86°		
Pyrmont, Hanover	Germany.	400	.....	616	Carbonated.
Connstadt, Würtemberg	Germany.	600	60°–70°	.....	Carbonated.
Wiesbaden, Nassau	Germany.	323	142°–156°		
Salzbrunn, Bavaria	Germany.	1,200	46°		
Baden-Baden	Germany.	616	140°–154°		

The alkaline waters are those that contain a large proportion of sodium carbonate, which is usually associated with a more or less carbonic acid. In the event of the carbonic acid being present in a fairly large percentage, the water is known as acidulous alkaline; when the sodium carbonate is associated with sodium chloride it is called a chlorinated alkaline water; and when sodium or magnesium sulphate is present in sufficient quantity to produce their characteristic effects the water is known as an alkaline-saline water.

Gradeau injected large quantities of sodium carbonate into the blood-vessels of a dog, and Münch has administered large quantities of that salt to a man, but in each series of experiments the results were negative. The acids of the gastric juice decompose sodium carbonate, setting carbonic acid free, and forming sodium chloride, and, in certain fermentative conditions, sodium acetate, butyrate, and lactate. Experiments have shown that the ingestion of alkalies in small or moderate doses increases the secretion of gastric juice, and these alkaline waters may be administered for that purpose; large doses of the salt impair digestion and diminish appetite and nutrition.

The salt does decrease the proportion of solids and increase the fluids in the bile, and it makes the urine distinctly alkaline, in consequence of the neutralization of the sodium phosphate. The best effects of the drug may be obtained by its prolonged administration in small doses, rather than by the use of large doses. Consequently the value of alkaline waters is apparent, because they are not likely to be taken in such large quantities or of such strength that the undesirable effects of the sodium salt will be manifested. In the case of the chlorinated alkaline waters the effects of both of the sodium salts are obtained, and these waters are best administered when it is necessary to improve the blood or to avoid emaciation.

The alkaline waters are used in the treatment of those forms of *dyspepsia* associated with *hyperacidity*, and in phases of *gastric catarrh* in which large quantities of mucus are secreted, and the ingestion of the water before breakfast loosens the mucus as in gastric lavage. In all gastropathies in which there is hyperacidity, and in gastric dilatation, alkaline waters are contra-indicated. Cases in which analysis of the gastric juice after a test meal shows that there is a large quantity of acid should be treated with the stronger alkaline waters; if gastric lavage and stimulation are desired, the chlorinated alkaline waters are most suitable; and where gastric and hepatic torpidity are associated, the alkaline saline waters are most efficacious.

As sodium bicarbonate acts more rapidly as a diuretic than sodium chloride, and in small doses it seems to be followed by a greater excretion of the retrogressive products of metabolism of the uropoietic apparatus, alkaline waters are indicated in *pyelitis*, *ureteritis*, and *cystitis*. The urine becomes alkaline and is

less irritating, the catarrhal exudation becomes thinner and is not retained, and the condition of the affected mucous membranes is improved.

These waters are useful for *renal* or *cystic calculus* or the *uric-acid diathesis*, the water and its salts furthering the oxidation of uric acid and having a certain solvent influence on formations of this substance. The use of the water in cases of calculi of calcium phosphate or carbonate is not justified by chemical or physiological facts.

The value of these waters in *gout* is due to the effect of copious draughts of water with the contained salts on the processes of metabolism. In such conditions they are rarely so useful as the saline waters, though a course of the latter may be advantageously followed by a course of alkaline waters. Headache and other conditions associated with the uric-acid diathesis are benefited by the use of alkaline waters.

Sir William Roberts has referred to the fact that a considerable number of the springs to which gouty patients resort are strongly impregnated with the salts of sodium, and to the fact that it has been conclusively demonstrated that all the sodium salts act adversely on the solubility of sodium bi-urate, and hasten its precipitation. It may be inferred that the introduction of these salts into the circulation must tend to favour the occurrence of uratic depositions in the body; therefore it is not surprising to learn that not infrequently the first effect of these waters on a gouty patient is either to provoke a downright attack of gout, or to aggravate the symptoms under which he was suffering. This has been a common experience at spas, and the patients have been comforted with the assurance that this preliminary storm was a necessary prelude to the amendment that was to follow. In all likelihood the gouty exacerbation is due to the precipitation of the urates floating in the blood and lymph into the structure of the joint. Dr. Roberts advises that gouty persons should either entirely avoid springs that owe their activity to sodium salts, or should use them very sparingly; he considers that it is difficult to believe that they can do any direct good, and easy to believe that they can do direct harm.

Chlorinated alkaline waters have proved to be very useful in *bronchial catarrh*, and in *acute* and *chronic pharyngitis* and *laryngitis*.

The following table gives a list of some of the more important alkaline springs, and the proportion in a thousand of the more important solid and gaseous constituents:

NAME OF SPRING.	Situation.	Temperature.	Sodium bi-carbonate.	Sodium chloride.	Sodium sulphate.	Free carbonic acid.	Remarks.
Adams Spring, Lake Co.	California.	.....	8·8	0·6	.....	1,315	199·43 gr. solids to gal.; carbonated (acidulous).
Ætna Spring, Napa Co.	California.	.....	11·6	4·5	1·2	251	136 gr. per gal.
California Seltzer Spring	California.	.....	8·0	2·5	.....	Abundant.	186 gr. per gal.
Litton's Seltzer Spring	California.	.....	9·0	.....	.....	180	228·69 gr. per gal.
Vichy Springs, New Almaden.	California.	.....	31·0	5·0	.....	485	432·64 gr. per gal.
Geyser Spa, Sonoma Co.	California.	200·0°	3·0	1·5	0·5	.....	57·12 gr. per gal.
Highland Springs, Lake Co.	California.	60–82°	1·0–2·0	0·01–0·10	.....	.....	73–103 gr. per gal.
Manitou Springs	Colorado.	43°–60°	0·15–1·24	0·13–0·47	0·19–0·51	?	
Apollinaris Spring, Mill Creek	Montana.	40·0°	0·98	0·37	0·94	?	14·43 gr. per gal.
Rohitsch (Styria)	Austria.	55·4°	8·6	0·3	.....	348	
Radein (Styria)	Austria.	53·6°	4·3	0·6	0·2	879	
Giesshübel (Bohemia)	Austria.	50·0°	1·2	.....	.....	1,537	Chalybeate.
Chaudes-Aigues	France.	68°–180°	27·47	3·67	2·60	748	
Mont-d'Or	France.	106°–108°	0·5	0·3			
Neris	France.	114°–125°	24·38	10.39	26·68		
Vichy	France.	53·6°–100°	4·0–5·0	0·5	0·2	460–532	
Vals	France.	55·4°	7·1	0·1	0·2	1,039	Chalybeate.
Le Boulou	France.	60°–68°	141·75	49·55	Trace.	360	
La Bourboule	France.	54°–125°	1·86	3·15	0·20	Abundant.	Arseniuretted, chlorinated.
Royat	France.	66°–96°	1·3	1·7	0·1	379	Arseniuretted, chlorinated.
Vic-sur-cere	France.	60°	124·36	90.34	41·58	.....	Arseniuretted, chlorinated, cold.
Szczawnica	Gallicia.	51·8°	8·4	4·6	.....	711	Chlorinated.
Fachingen (Nassau)	Germany.	50·0°	3·6	0·6	.....	945	301·6 gr. to gal.; chalybeate.
Fellathalquellen (Illyria)	Germany.	46·4°	4·2	0·2	0·5	609	Chalybeate.
Bilin (Bohemia)	Germany.	53·6°	4·2	0·3	0·8	1,337	
Obersalzbrunn (Silesia)	Germany.	44·6°	2·4	0·1	0·4	630	
Apollinaris	Germany.	69·8°	1·2	0·4	0·3	1,500	
Geilnau	Germany.	50·0°	1·0	.....	.....	1,468	
Ems	Germany.	96°–116°	1·3–2·0	0·9–1·0	.....	553–597	Chlorinated.
Weilbach	Germany.	53·6°	1·3	1·2	0·2	151	Lithia.
Selters	Germany.	60·8°	1·2	2·2	.....	1,149	

Sulphated, or bitter, waters are those saline waters in which there is a large proportion of sodium or of magnesium sulphate or of both these salts. When the principal constituents are the salts mentioned these waters have been called simple sulphated, or bitter, waters; when they are combined with sodium carbonate, sodium chloride, and other salts, they are known as alkaline sulphated waters.

Neither magnesium nor sodium sulphate is

a normal constituent of the organism, and, while their action has been described in the sections devoted to those substances, some remarks may be pertinent here. Although the nauseous taste of sodium sulphate has interfered with the general employment of that drug, it is less irritating than magnesium sulphate, and is to be preferred to the latter salt in many instances. Braun is authority for the statement that the irritating effect of magnesium sulphate on the mucous membrane of the stomach is about fifty per cent. greater than that of sodium sulphate.

Buchheim's investigations have shown that in the intestinal canal the potassium salts take a certain quantity of sulphuric acid from these sulphates, the salts being reduced to sulphides, which are decomposed by the acids of the intestinal canal, with the generation of hydrosulphuric acid. In general, these sulphates act by increasing the fluids of the intestinal canal.

One of the most important uses of the waters of this class is for the treatment of the various *disorders of the stomach*. The researches of Jaworski on the effects of Carlsbad water have shown that, if it is taken in small quantities and for a short time, it stimulates the gastric secretion, but, if administered for a long time, it lessens and perhaps stops that secretion. Boas has stated that its prolonged use will cause atrophy of the glandular parenchyma of the stomach. Spitzer found that these waters increased the motor power of the stomach and the secretion of pepsin, but checked an excessive elimination of hydrochloric acid.

Ewald's experience has been that the alkaline sulphated waters have such a high percentage of alkali that they act as *antacids* in conditions of *gastric hyperacidity*. While the simple mechanical action of gastric lavage is incidental to the use of almost all mineral waters, the waters under consideration have a further action on the liver and intestines. Cordes has called attention to the fact that such waters, when given to nervous or anæmic persons, may cause an increase in the irritation and depression; and Ewald adds an emphatic protest against the custom of sending persons so afflicted to springs where the water contains large quantities of sodium sulphate, because the waters operate badly in every case. Persons affected with pronounced neuroses should not be sent to such spas or treated with such waters, because of the reflexes that proceed from the stomach and intestines.

In *hyperacidity* or *increased secretion of gastric juice* these waters are likely to prove beneficial, and it is on account of the existence of the first-named condition with *gastric ulcer* that these waters are useful in the treatment of that disease, as the water not only neutralizes the acidity but lessens the secretion of the gastric juice. The sulphated waters are indicated in those gastropathies that complicate and are due to disorders of the liver and intestines.

Simple *chronic intestinal catarrh* is often benefited by the use of a sodium-sulphate water, though in aiding in the removal of effete matter they may interfere in the final digestion of nutritious substances.

In *hepatic engorgement, jaundice due to obstructions*, and *hepatic cirrhosis* the waters containing sodium sulphate are very useful. The obstruction to the circulation in the portal vein reacts on all the veins of the intestinal tract, and the engorged capillaries are relieved by the exosmosis induced by the water. With an improvement in the local circulation there is improvement in the general nutrition of the affected region. *Catarrh of the duodenum* and of the *gall bladder* and *duct* are benefited in consequence of the depletion of the engorged intestinal vessels and mucous membrane and the removal of the mucus. Gallstones are passed after a more or less prolonged course of saline waters.

Corpulence has been successfully treated with saline waters, but no small part of the benefit attending their use is due to the rigorous dietary regimen, including the abstinence from starchy and fatty foods and alcoholic or malt beverages. Too often the benefit derived from a course of the waters is lost by the patient's resuming the habits of living which originally tended to produce the corpulence. During the use of the waters there is an increased elimination of proteid matters and fats by the bowels, and a diminution in the phosphoric and sulphuric acids and the chlorides and an increase of urea in the urine. In such conditions the use of the treatment should be indicated and supervised by a physician.

Diabetes due to defective metabolism of the carbohydrates may be benefited by saline waters.

The depletion of the intestinal vessels that follows a course of sulphated waters is of decided value in the treatment of *hæmorrhoidal conditions*, which so often occur in those who may be considered degenerative assimilators. Here also the improvement in metabolism is the cause of the particular improvement in the patient. But hæmorrhoidal conditions in thin individuals whose physique indicates defective assimilation are aggravated by such waters.

In maladies due to the so-called *uric-acid diathesis*, as well as in *gravel* and *stone in the kidney* or *bladder*, the alkaline-saline waters promote the solution of uric acid.

The degree of intensity of purgative action in the bitter waters varies necessarily with the amount of sulphates that they contain. To a greater or lesser extent all of them increase the quantity of solids passed from the bowels during the day, because, in consequence of the purgative effects of the waters, the peristaltic action of the intestines is increased, the food passes through and out of the digestive canal before all the nutrient material has been absorbed from it by the lacteals, and, as the late Dr. George Harley remarked, more feculent matter is excreted by the bowels than would have been the case had the digestive materials sojourned longer in the intestinal canal and have been absorbed to nourish the body.

Another fact that must not be overlooked is

that the thirst produced by the saline constituents of these waters increases the quantity of liquids ingested, and the more liquids that are absorbed the greater the solution of solids and the greater the elimination by the kidneys of both fluids and solids. This latter, however, is but temporary, as the continued use of sulphated waters decreases the time during which nutritive material remains in the digestive tract; and in consequence of this there are lessened absorption by the lacteals and a smaller excess in the blood to be excreted in the urine.

The following table includes the principal waters of this class:

NAME OF SPRING.	Situation.	Magnesium sulphate.	Sodium sulphate.	Magnesium chloride.	Sodium chloride.	
		Per 1,000 parts water.				
Crab Orchard Springs	Kentucky.	0·07	0·02	....	0·01	
Harrodsburg Springs	Kentucky.	33·40	....	....	1·5	
Bedford Springs	Pennsylvania.	6·0	0·1	....	0·09	Chalybeate.
Arpad (Hungary)	Austria.	17·43	16·25	....	1·32	
Franz-Joseph Bitterquell	Austria.	24·7	23·1	....	1·7	
Hunyadi János (Ofev)	Austria.	16·0	15·9	1·3		
Sedlitz (Bohemia)	Austria.	13·5	....	....	0·3	
Püllna (Bohemia)	Austria.	12·1	16·1	....	2·4	
Saidschutz (Bohemia)	Austria.	10·9	6·0	....	0·2	
Ivanda (Banat)	Austria.	2·4	12·4	2·3		
Unter-Alap (Hungary)	Austria.	4·0	18·1	14·4		
Marienbad (Bohemia)	Austria.	....	5·0	....	2·0	Alkaline.
Franzensbad (Bohemia)	Austria.	....	3·5	....	1·1	Alkaline.
Karlsbad, Mühlbrunnen	Austria.	....	2·3	....	1·0	Alkaline, 125° F.
Karlsbad, Sprudel	Austria.	....	2·3	....	1·0	Alkaline, 158° F.
Karlsbad, Schlossbrun	Austria.	....	2·2	....	0·9	Alkaline, 122° F.
Fuered (Hungary)	Austria.	....	0·7	....	...	Alkaline.
Brides-les-Bains	France.	0·50	1·25	...	1·94	Carbonated, 95° F.
Montmirail	France.	9·3	5·0	....	0·8	
Mergentheim (Würtemberg)	Germany.	5·4	6·6	16·1		
Friedrichshall (Saxe Meiningen)	Germany.	5·1	6·0	7·9	3·9	
Kissingen (Bavaria)	Germany.	5·0	5·8	7·6	3·8	
Elster (Saxony)	Germany.	....	5·2	....	0·8	Alkaline.
Bertrich (Coblentz)	Germany.	....	0·9	....	0·4	
Rubinat	Spain.	3·17	93·23	....	1·99	
Tarasp (Engadine)	Switzerland.	....	2·1	....	3·6	
Birmensdorf	Switzerland.	22·0	7·0			

Ferruginous, chalybeate, or iron waters are those in which there is a sufficient amount of some iron salt, usually the carbonate, chloride, or sulphate, to give the water a characteristic styptic taste and the therapeutic properties of those salts. While iron is contained in a large number of mineral waters, the quantity is usually so small that it exercises no appreciable medicinal effect. If an appreciable quantity of sodium bicarbonate is associated with the iron, the water is called an alkaline chalybeate water; if there is enough sodium sulphate to produce medicinal effect, the water is called a saline chalybeate water; if sodium chloride is present in sufficient quantity, the water is termed chlorinated, or muriatic-acidulous chalybeate water; and if it contains calcium carbonate or sulphate, it is designated as earthy, or calcic-acidulous, chalybeate water.

The iron is probably absorbed with the water from the stomach and intestinal tract, the process of absorption being furthered if there is carbonic-acid gas in the water. The latter is always present when there is carbonate of iron, which is only held in solution by an excess of acid.

The iron increases the red blood-corpuscles, stimulates the appetite, and strengthens digestion by increasing the desire for food and the ability to dispose of it. But more essential in the treatment of *chlorosis* or *anæmia* at a spa is the change in the mode of life—the diet, the life in the open air, and the removal of disturbing local influences that may exist at the patient's home. The quantity of iron, varying from half a grain to two grains, that is contained in all the water that is drank in a day, seems too small to be considered as the sole factor in the improvement that occurs in the diseases mentioned.

Ferruginous waters are of special value in those forms of *anæmia* due to hæmorrhage, suppuration, or protracted acute or chronic diseases. In *chlorosis*, in the *cachexia associated with chronic paludal poisoning*, in that consequent on *the prolonged use of mercury in syphilis*, in *chronic lymphadenitis*, in *chorea*, in *menstrual derangements of hæmic origin*, in *albuminuria*, and in *neurasthenia* these waters may be prescribed with advantage, and a saline or chlorinated chalybeate spring is preferable. Sometimes the administration of a chalybeate water causes intestinal torpidity, and, as in chlorosis there is often self-intoxication due to constipation, the use of iron water must be discontinued or be associated with that of a saline water. Dyspepsia or diarrhœa that appears during the use of iron waters indicates the necessity of discontinuing the treatment, unless warming the water terminates the disorders mentioned.

In chronic forms of paludal poisoning the iron waters that contain arsenic, such as those of Roncegno and Levico in the Austrian Tyrol, are especially indicated. Such waters are excellent for weak and delicate persons who are affected with *gastric neuroses*, because their use may be continued for a long time. In all diseases these waters should be adminis-

tered at first in small doses, a tablespoonful half an hour after luncheon sufficing: this dose is gradually increased up to two or three tablespoonfuls three times a day.

Atony of the stomach is improved by the administration of acidulated (carbonated) chalybeate waters.

The following is a partial list of chalybeate springs of the United States and of Europe:

NAME OF SPRING.	Situation.	Remarks.
Bailey Springs, Lauderdale Co.	Alabama.	Alkaline chalybeate.
Cullum's Springs, Choctaw Co.	Alabama.	9·64 gr. iron bicarbonate in a gal.
Talladega Spring, Talladega Co.	Alabama.	8·78 gr. iron carbonate in a gal.
Fulton Wells	California.	13 gr. iron subcarbonate in a gal. ; sulphuretted.
Linwood Spring	Florida.	9·6 gr. iron bicarbonate in a gal. ; chlorinated.
Angier's Mineral Spring	Georgia.	12·5 gr. iron sesquioxide in a gal. ; carbonated.
Schuyler County Spring	Illinois.	69·96 gr. iron protosulphate in a gal. ; calcic.
Benham's Carburetted Saline Well	Indiana.	10·71 gr. iron carbonate in a gal. ; saline.
Indian Springs	Indiana.	24·28 gr. iron sulphate in a gal. ; calcic.
Ott's Well	Indiana.	14·66 gr. iron carbonate in a gal. ; calcic.
Iowa Acid Spring	Iowa.	97·3 gr. iron sulphate in a gal. ; acidulated.
Cherokee Magnetic Mineral Spring	Iowa.	11·26 gr. iron carbonate in a gal. ; calcic.
Owosso Chalybeate Spring	Michigan.	15·92 gr. iron bicarbonate in a gal. ; calcic.
Bratton Spring	Missouri.	36·74 gr. iron sulphate in a gal. ; calcic.
Fairview Mineral Spring	Missouri.	18·73 gr. iron bicarbonate in a gal. ; carbonated.
Chittenango Springs	New York.	20·78 gr. iron carbonate in a gal. ; acidulated.
Oak Orchard Acid Spring	New York.	14 to 39 gr. iron sulphate in a gal. ; acidulated.
Kittrell Springs	North Carolina.	9·2 gr. iron carbonate in a gal. ; acidulated.
Iron Spring (Warm Springs)	North Carolina.	31·9 gr. iron in a gal. ; acidulated.
Green Mineral Spring	Ohio.	19·7 gr. iron carbonate in a gal. ; acidulated.
Stryker Mineral Well	Ohio.	9·93 gr. iron bicarbonate in a gal. ; chlorinated.
Payton Mineral Spring	Oregon.	62 gr. iron carbonate in a gal. ; chlorinated.
Cresson Springs	Pennsylvania.	23 to 33 gr. iron sulphate in a gal. ; saline.
Kittanning Mineral Spring	Pennsylvania.	24 gr. iron sulphate in a gal. ; calcic.
Guylych and Gaylord's Spring	Pennsylvania.	73·06 gr. iron sulphate in a gal. ; calcic.
Blossburg Springs	Pennsylvania.	31·32 gr. iron persulphate in a gal. ; acidulated.
Austin's Spring	Tennessee.	6·4 gr. iron sulphate, 11·2 gr. iron oxide } in a gal.
Pate Sour Well	Texas.	69·16 gr. iron sulphate in a gal. ; saline.
Sour Lake Mineral Springs	Texas.	7 to 17 gr. iron sulphate in a gal. ; acidulated.
Wootan Wells	Texas.	13·06 gr. iron sesquioxide in a gal. ; acidulated.
Montebello or Newbury Springs	Vermont.	45·04 gr. iron carbonate, 13·2 gr. iron sulphate } in a gal.
Bath Alum Springs No. 2	Virginia.	26·7 gr. iron persulphate in a gal. ; chlorinated.
Bedford Alum and Iron Springs	Virginia.	19·26 gr. iron persulphate in a gal. ; carbonated.
Church Hill Alum Spring	Virginia.	158·79 gr. iron salts in a gal.
Jordan Alum Springs	Virginia.	18·54 gr. iron sulphate in a gal.
Pulaski Alum Springs	Virginia.	108·75 gr. iron sulphate in a gal.
Stribling Springs	Virginia.	12·13 gr. iron sulphate in a gal.
Rock Enon Springs	Virginia.	14·25 gr. iron oxide in a gal.
Wallawhatoola Alum Springs	Virginia.	23·74 gr. iron persulphate in a gal.
Sparta Mineral Wells	Wisconsin.	14·34 gr. iron carbonate in a gal.
Szliacs (Hungary)	Austria.	46 gr. iron bicarbonate in a gal. ; carbonated.
Pyrawarth	Austria.	50 gr. iron bicarbonate in a gal. ; carbonated.
Franzensbad (Bohemia)	Austria.	8 gr. iron bicarbonate in a gal. ; saline.
Spa	Belgium.	Iron bicarbonate.
Flitwick	England.	Iron sulphate.
Harrogate	England.	2·96 gr. iron in a gal.
Tunbridge Wells	England.	6 grs. iron salts in a gal.
Bussang	France.	1·7 gr. iron bicarbonate in a gal.; carbonated.
La Malou (Herault)	France.	Iron bicarbonate.
St. Pardoux (Allier)	France.	Iron bicarbonate.
Charbonnières	France.	Iron bicarbonate.
Homburg	Germany.	7 gr. iron bicarbonate in a gal. ; chlorinated.
Elster (Saxony)	Germany.	Iron bicarbonate ; saline.
Schwalbach (Taunus)	Germany.	Carbonated.
Bocklet	Germany.	Iron bicarbonate ; saline.
Driburg (Westphalia)	Germany.	Iron bicarbonate ; alkaline.
Pyrmont (Waldeck)	Germany.	Iron bicarbonate ; alkaline.
Alexisbad (Black Forest)	Germany.	Iron bicarbonate.
St. Moritz (Engadine)	Switzerland.	Iron bicarbonate ; alkaline.
Tarasp	Switzerland.	Iron bicarbonate ; alkaline.

Sulphur waters are those that owe their chief characteristic to the presence of sulphuretted hydrogen, either as a free gas or in combination with calcium, magnesium, potassium, or sodium. They are easily recognised by their fœtid smell, resembling the odour of rotten eggs.

It is difficult to distinguish the remedial effects of the sulphuretted hydrogen from those of the salts with which it is associated. Sometimes waters that contain this gas will produce a sense of heat in the stomach, excite gastric distress, and eventually cause unpleasant eructations of sulphuretted hydrogen; but in moderate doses, and if the waters contain also sodium chloride, they stimulate the secretions of the gastro-intestinal canal. Continued for some time, these waters impair the red blood-corpuscles, possibly in consequence of the action of sulphur on the hæmoglobin, and anæmia, debility, and wasting result. The sulphuretted hydrogen is absorbed by the blood of the capillaries of the mucous membrane of the intestinal tract, and it is eliminated by the lungs and the skin, and possibly a small quantity is excreted by the urine.

Röhrig immersed rabbits in water saturated

with sulphuretted hydrogen, but arranged the animals so that they breathed atmospheric air; death ensued in eighteen minutes in consequence of the absorption of the gas. This permeability of the skin by sulphuretted hydrogen is made use of in the treatment of certain diseases, especially *saturnism* and *mercurialism*, by baths.

Braun stated that he had personally experienced the influence of sulphuretted waters in relieving *congestion associated with enlargement of the liver*. The gas is transmitted by the blood of the portal vein, and it combines in the liver with the iron of degenerating blood-corpuscles, forming an iron sulphide, which is excreted by the fæces. Such treatment is particularly indicated for patients who can not use the saline waters because of intestinal catarrh.

Hepatic congestion associated with *bronchial catarrh*, *hæmoptysis*, and even *pulmonary tuberculosis*, is benefited by the use of these waters. The Bergeon treatment of tuberculosis by inhalations and rectal insufflations of sulphuretted hydrogen that is obtained from some strongly impregnated water still has its advocates.

Internally, these waters may be used as a laxative in *constipation* due to deficiency of intestinal secretion. *Hæmorrhoids* due to defective circulation in the intestinal vessels are benefited by these waters, as is *engorgement of the pelvic viscera* in women.

Braun suggested that the fact that the liver was the main depot for retained metallic poisons afforded an explanation of the benefit derived from the administration of sulphur water in *chronic poisoning by lead* or *mercury*. In saturnism and mercurialism they may be given as draughts, baths, and inhalations (nebulized).

While the use of sulphur waters externally and internally has had great vogue in the treatment of various skin diseases, there is no good evidence to prove that they are therapeutically useful.

The use of baths of sulphur water or of sulphur vapour, as in the case of Glenwood Springs, Colorado, has relieved certain cases of *chronic* and *muscular rheumatism* and *gout*. The influence of the heat and moisture and that of the salts contained in the water must not be overlooked.

The value of sulphuretted-water baths in the various forms of syphilis and in paralysis is no greater than that of warm water.

Most of these waters owe their therapeutic value to the salts they contain rather than to the sulphuretted hydrogen or the sulphides.

The waters of Aix-la-Chapelle, or Aachen, enjoy a general European reputation for their efficacy in the treatment of rheumatism, gout, and syphilis. Dr. E. P. Philpots (*Bristol Medico-chirurgical Journal*, 1885, p. 104) states that after a person with *syphilis* has remained in water of a temperature of 95° F. for half an hour, he is dried and rubbed with about three drachms of mercurial ointment; the solæi muscles being rubbed one day, the thighs the next, then the abdomen, thorax, arm, forearm, and back, and then the solæi receive an inunction again. The patient is given a mouth wash of potassium chlorate, and if salivation occurs the inunctions are discontinued for a day or so. From twenty to eighty baths and inunctions are given in each course.

Aix-les-Bains is frequented by the English and French because of its proximity to London and Paris. Sir Alfred B. Garrod (*Lancet*, 1887, vol. i, p. 869) said he had known a patient to leave London at eleven o'clock one morning and finish the first day's treatment by the same hour the following day. He thought the best season there was from May 10th to June 10th, or from the end of August to the end of September. The hot sulphur mineral douche, the massage, and the internal administration of the sulphur waters relieve *rheumatoid arthritis*, *muscular rheumatism*, *sciatica*, and other *neuralgic affections*, and cutaneous affections associated with rheumatoid arthritis and gout.

The United States is particularly rich in springs that contain this gas, and in the list there will be found mention of such waters. Of the European spas the more important hot springs are those of Baden (temperature 131° F.), near Vienna, the Herculesbad (111·2°) at Mehadia, the springs at Harkany (143·6°), Grosswardein (113°, saline), Pystjan (173·7°, carbonated), Trenchin-Teplitz (104°, calcic), and Warasdin (134·6°, carbonated), in Hungary; Abano and Battaglia (73·7° to 160°, chlorinated), in Italy; Barèges (88° to 111·2°, calcic), Bagnères-de-Bigorre, Bagnères-de-Luchon (154°), Amélie-les-Bains (108° to 141·8°, calcic), Cauterets (102·2°), Eaux-Bonnes (89·6°), Saint-Sauveur (93·56°), and Vernet, in the French Pyrenees; Aix-la-Chapelle (131°, saline), in Germany; Aix-les-Bains (114·8°), in Savoy; Ponticosa (77° to 91·4°), in Spain; and Baden (114·8, saline), Lavey (109·4°, saline), and Schinznach (109·4°, saline), in Switzerland.

Among the cold sulphur springs are those of Harrogate, in England; Lisdoonvarna, in Ireland; Eilsen, Neundorf (calcic), Weilbach (carbonated), Meinberg (carbonated), Langenbrücken, Hohenstedt, Sebastiansweiler, and Kreuth, in Germany; Enghien, in France; Strathpeffer, in Scotland; and Alvenu, in Switzerland.

Certain mineral waters which contain an appreciable quantity of lithium salts are referred to as lithia waters, but the reports in regard to their therapeutic virtues are commoner in the secular press and in descriptive circulars than in the pages of medical journals. The Londonderry lithia water, from Nashua, New Hampshire, the Buffalo lithia water, the Farmville lithia water, and the Bowden lithia water have been extolled as remedies for a number of diseases. How much of their efficacy is due to the quantity of water imbibed and how much to the lithium salt is a matter for scientific research. Sir William Roberts (*On the Chemistry and Therapeutics of Uric-acid Gravel and Gout; Croonian Lectures*, 1892) has called attention to the fact that, because solutions of lithium carbonate and piperazine

possess a high solvent power for free uric acid, it has been inferred from this fact that their administration internally might exercise a favouring influence on the solubility of sodium bi-urate in the bodily fluids, and thereby tend to prevent the formation of uratic deposits. This inference, however, he does not deem justifiable. He found experimentally that the addition of lithium or piperazine, in the proportion of 0·1 per cent. and 0·2 per cent., to blood-serum or synovial fluid did not have the slightest effect in enhancing the solvent power of these media on sodium bi-urate or in retarding its precipitation from serum and synovia artificially impregnated with uric acid. Sir William considered that if the remedies mentioned have any effect in gout, it is certainly not due, as has been supposed, to their solvent action on the material of gouty concretions.

Dr. J. H. Claiborne (*Virginia Medical Monthly*, 1889, xvi, p. 708) says he has prescribed Buffalo lithia water for a number of years in cases of *lithiasis*, *uræmia*, *Bright's disease*, *cystitis*, and *nephritic colic* with satisfactory results. The ingestion of large quantities of water, from half a gallon to a gallon in a day, often causes the solution of gravel, and it is passed as sabulous matter. Dr. James Shelton (*Virginia Medical Monthly*, 1887, xiv, p. 440) has found that the water from spring No. 1 relieves *functional neuroses*, *amenorrhœa*, *dysmenorrhœa*, *menorrhagia*, the *cachexia* and *sequelæ of paludal fevers*, *dyspepsia*, *scarlatinal nephritis*, *diabetes mellitus*, *syphilis*, *gleet*, *hepatic engorgement*, *eczema*, and *acne*.

[Dr. George Halsted Boyland (*New York Medical Journal*, August 22, 1896), who was formerly resident physician at the Buffalo Lithia Springs, says he is satisfied that there is no other mineral water either in America or in Europe so singularly adapted to such a large number and variety of maladies. He says: "The solvent properties of all three springs on grape sugar is immediate (as can be readily proved by placing 10 or 20 grains in a test tube and adding half an ounce of water), and their great value in the treatment of *diabetes mellitus* is attested by numerous cases." He has found the waters useful also in *jaundice*, *albuminuria*, and those cases of *inflammation of the vermiform appendix* that are dependent on the formation of phosphatic deposits in the appendix.]

Earthy, or calcareous, waters are those which contain such earthy substances as calcium carbonate and sulphate and magnesium carbonate as prominent constituents. The calcium bicarbonate in mineral waters is usually first reduced in the stomach to a carbonate before it can be changed into calcium chloride or lactate, and it reappears in the fæces as calcium carbonate or phosphate.

Internally, the constituent salts of these waters have some action as *antacids* and act as *astringents*. The acidity of the urine is diminished or that excretion may be made alkaline.

The alkaline are preferable to the earthy waters in cases of gastric catarrh with hyperacidity. The bactericidal property of the calcium salts may be of value in *diarrhœa accompanied by intestinal catarrh*. There is no evidence to support the theory that these waters are of value in caries, necrosis, osteomalacia, or other bone diseases, and they do not hasten the calcification of tubercles. Externally, these waters have proved useful in *gouty* and *rheumatic affections* and some *chronic exanthemata*, probably because of the presence of carbonic acid in the water. While these waters have been used in the treatment of bronchial catarrh, cystitis, hepatic and cystic calculi, and certain skin diseases, there is no good evidence to justify the belief that the calcium salts have exercised any therapeutic effect.

These springs—in which the sum of mineral constituents does not exceed the amount present in ordinary potable water, in which there is no sodium, or only a small trace of it, and in which the principal ingredient is a small percentage of calcium carbonate or sulphate—are likely to be of value in the treatment of gout. Most if not all of the calcium salt probably passes out in the fæces, so that such springs depend upon their watery constituents. As the waters are taken freely and usually on an empty stomach, they dilute the blood temporarily and lower its percentage of urates and sodium salts, and thus retard or prevent the precipitation of urates, and give the defective kidneys more time for the task of eliminating uric acid. Among the springs particularly indicated in gouty conditions are those of Bath and Buxton in England; of Aix-les-Bains, Barèges, Contrexéville, and Vittel in France; and of Gastein, Pfäffers, and Wildbad in Germany.

The list of springs in the various States makes mention of the calcic waters in the United States. In Europe, the better known spas are those of Bigorre, Crausac, Contrexéville, St. Armand, St. Galmier, and Vittel, in France; Inselbad, near Paderborn, Driburg and Lippspring, in Westphalia, and Wildungen in Waldeck, in Germany; and Leuk, in Canton Wallis, and Weissenburg, in Canton Bern, in Switzerland. Calcium sulphate is found in medium amounts in the Püllna, Sedlitz, Saidschütz, Iwanda, and Friedrickshall saline waters; in the Mergentheim, Bourbonne, Cannstadt, Schmalkalden, Rehme, Wildegg, and Mondorf chlorinated waters; and in the Neundorf, Schinznach, Eilsen, and Luben sulphur waters. Carbonate of calcium is found in the waters of a number of spas as an associated salt.

Though the use of mineral waters is indicated at all seasons of the year, there are certain times when the springs in this country and in Europe are in season. At a number of these resorts the hotels are open only during certain months in the year, and at other times accommodations are likely to be inferior. The use of the waters at home, while not without advantage, is less likely to be followed by the improvement that occurs when they are taken at the springs, where the change of air and scene add their influence to the medicinal properties of the water, and where the details of diet and mode of life are more punctiliously attended to.

The season at most of the resorts extends from May to October, though at some it is

from June to September, while some—like Glenwood Springs, Colorado, Warm Springs, North Carolina, or Hot Springs, Arkansas—are open all the year, the winter and spring months being most popular at the two last-mentioned resorts. Certain resorts in Europe are not closed at any season, such as Aix-les-Bains, Aix-la-Chapelle, Amélie-les-Bains, Baden-Baden, Bath, Dax, and Wiesbaden.

The possibility of more outdoor life during a sojourn in the warm months of the year is a factor that should be considered by the physician in selecting a resort, especially for persons with diseases that are likely to be affected by variability in the weather or by confinement in the house.

The length of treatment may best be determined by the resident physician at the springs. Power of recuperation, as well as impressibility, varies in different individuals, and there are instances in which an apparently suitable spa proves to be disadvantageous to a patient. It is therefore inadvisable for the physician who recommends a course of treatment to lay down any specific rule.

If the resident physician at such a resort is a competent man, he can best report on the improvement, and, as the length of sojourn should be commensurate with the advantages that are derived from it, it would be best to direct patients to follow such advice. Obviously, it would be impossible for a physician at a distance to know of the features of the change in a patient affected with anæmia, but the resident physician, who should make regular observations with the hæmoglobinometer and hæmatocrite, is prepared to speak with positiveness on the benefit afforded by the resort. This same is true in the several forms of nephritis, in which regular urinary analysis affords positive information of the condition of the kidneys and of the influence of the water on their action. In gastric disorders the examination of the performance of stomach digestion is essential. In fact, few diseases should be treated at these places without the regular use of the methods of precise examination rather than the perfunctory questioning of the patient and advice based on interpretation of his statement of his condition. It is needless to say that there are very few resorts in this country where such systematic methods are in vogue, and until such advice can be secured the resorts of Europe are likely to be patronized by Americans rather than those of the United States. The empirical administration of iron, mercury, potassium iodide, or quinine is likely to be less advantageous to a patient than the use of any of these drugs after careful consideration of the evidence afforded by the use of instruments of precision. The writer would not overrate the value of the latter, which will prove of little use if unassociated with good judgment and experience; but it is only by the aid of all such methods that physicians can escape the old-time reproach that they were a class "engaged in pouring drugs of which they knew nothing into stomachs of which they knew less."

The question in regard to the desirability of a person's returning home immediately after a course of treatment, or of going to some other place for a longer or shorter time, should be decided by the resident physician at the springs. In many instances, especially in gastric, renal, or hepatic affections, it is essential for the patient to enhance or fortify his condition after the improvement afforded by a course of mineral waters, and some weeks at a well-selected place will insure abstinence from work and a continued attention to the details of diet.

The question in regard to the choice of mineral waters and their applicability to different patients is as unsettled as that of the selection and administration of other remedial agents. Every factor that plays a part in the choice of a suitable medicament must be considered as well in the selection of a mineral water that is likely to benefit a patient. But in choosing the latter it is necessary to consider not only the character of the disease, the degree to which the organs affected are involved, the general condition of the patient, and the analogous factors, but also the patient's ability to stand the journey to the springs, the effects of the various factors besides the waters that exist at such resorts, and the season of the year when the visit should be made.

Dr. Julius Braun has very truly said (*On the Curative Effects of Baths and Waters.* Translated by Hermann Weber, M. D.): "Cases of sickness of very different kinds are cured and improved by one and the same medicinal spring, and cases of similar nature are cured and improved by very different medicinal springs."

Dr. A. C. Peale, who prepared the list of the mineral springs of the United States that was published in Volume V of the *Bulletins of the United States Geological Survey*, collected data that must serve as a basis for all future work in this field.

The writer would acknowledge his obligation to that list, which has materially aided his personal observations, and he reproduces herewith Dr. Peale's summary of the springs in the different geographical divisions of this country:

STATES.	No. of spring localities.	No. of individual springs.	No. of springs analyzed.	No. of springs used as resorts.	No. of springs used commercially.	Total number of analyses of waters.
Northern Atlantic States	405	657	155	74	72	187
Southern Atlantic States	371	1,048	148	152	42	164
Southern Central States	721	1,911	137	174	36	146
Northern Central States	601	1,276	215	122	55	224
Western States and Territories	724	3,951	132	112	18	138
Total	2,822	8,843	787	634	223	859

From this table it may be seen that less than 10 per cent. of the number of mineral springs in this country have had their waters analyzed, while but little more than 20 per cent. of the places where mineral waters are found are used as resorts.

Alabama contains a number of mineral springs, though few of them have anything more than a local reputation, and the waters of but few have been analyzed. Those that are used as resorts have much to be desired in the matter of accommodation for visitors. Bailey Springs, in Lauderdale County, Chandler's Springs, in Talladega County, and Greene Springs, in Hale County, are chalybeate springs. Bladon Springs, in Choctaw County, is an alkaline, carbonated, and sulphuretted water, similar to that of Aachen. At Blount Springs there are five saline sulphuretted springs, and a somewhat similar water is found at Cullum's Springs, in Choctaw County. There are sulphuretted and chalybeate springs at Blue Grass Sulphur Springs, near Cornelia; at Coffee Springs, in Geneva County; at Tallahatta Springs, in Clarke County, and at White Sulphur Springs, in Calhoun County.

Alaska has within its area a number of hot springs, the better known of which are the saline-sulphuretted springs (temperature, 153° F.) north of New Archangel, Sitka Island. There are also cold springs of chalybeate, saline, and sulphuretted waters, no analyses of which have been made.

In *Arizona* there are hot springs (temperature, 130° F.) above the mouth of the San Francisco River; the Monroe Hot Springs (temperature, 150° to 160° F.), south of Prescott, are used for bathing, and there is a number of carbonated, sulphuretted, alkaline, and saline springs, none of which is used as a resort.

Arkansas is better known from its hot springs than from any other feature of the State. There are some seventy springs situated in a picturesque valley that is easily accessible and is supplied with excellent hotel accommodations—too frequently the feature that is lacking in the spas in the United States. There is no characteristic feature in either the temperature or the ingredients of this water to make it superior to many other thermal springs in this country. But it has had a certain popularity in the treatment of *constitutional syphilis* and *chronic rheumatism* and *gout*, and fashion has served to enhance its position among such resorts. The consensus of opinion of expert physicians at Hot Springs is that the therapeutic value of these waters is due more to physical properties than to chemical combination (Dr. T. M. Baird, *Hot Springs Medical Journal*, 1894, vol. iii, p. 3; Dr. W. H. Barry, *ibid.*, 1892, vol. i, p. 103; Dr. G. W. Galvin, *New York Medical Journal*, 1887, vol. xlv, p. 656; Dr. J. T. Jelks, *Atlanta Medical Register*, 1881, vol. i, p. 513; Dr. J. M. Keller, *St. Louis Medical and Surgical Journal*, 1879, vol. xxxvii, p. 83; Dr. E. R. Lewis, *Journal of the National Association of Railway Surgeons*, 1889, vol. ii, p. 6). As soon as this water is allowed to stand or to flow in the open air a large amount of deposit will occur. The external and internal use of these waters is useful in *gout*, *rheumatism*, *neuralgia*, incipient *Bright's disease*, *cystitis*, *functional disease of the liver*, *chronic diarrhœa*, *chronic skin diseases*, especially of squamous types, and *malarial toxæmia*.

[An editorial writer in the *New York Medical Journal* for December 1, 1894, says:

"If we were to base our judgment on chemical analyses alone, it would be puzzling to account for the cures wrought by the waters; practically, they contain nothing but silica. Nevertheless they do bring about unquestionably the recovery of many an invalid doomed without their aid to years of drooping health and an untimely death. How do they do it? The local physicians say that it is by virtue of their occasioning a marvellous activity of the emunctories, whereby the system is enabled to tolerate huge doses of active drugs, while at the same time the patient, hoping for something akin to a miracle, subordinates all his thoughts to the effort to get well and obeys his physician's instructions implicitly.

"Recognising the efficacy of a sojourn in the romantic city of Hot Springs, together with a systematic use of its thermal waters, the Government has established on its reservation there a general hospital for the benefit of officers and enlisted men actually in the service and suffering from ailments that have been contracted in the line of duty and have resisted treatment at other military or naval hospitals. . . . A circular issued from the Adjutant-General's office says:

"'Relief may reasonably be expected at the Hot Springs in the following conditions: In the various forms of *gout* and *rheumatism*, after the acute or inflammatory stage; *neuralgia*, especially when depending upon gout, rheumatism, metallic or malarial poisoning; *paralysis*, not of organic origin; the earlier stages of *locomotor ataxia*, or tabes; the early stages, only, of *Bright's disease; diseases of the urinary organs; functional diseases of the liver; gastric dyspepsia* not of organic origin; *chronic diarrhœa; catarrhal affections of the digestive* and *respiratory tracts; chronic skin diseases*, especially the squamous varieties; and chronic conditions due to *malarial infection*. Speaking generally, treatment by the Hot Springs water may be said to stimulate all the secretions and the organic functions, to promote digestion and assimilation, and to favour tissue metamorphosis and excretion, thereby relieving internal congestions, stimulating blood-making, increasing the appetite, and favouring new and healthy tissues at the expense of the old and inactive. The Hot Springs water is contra-indicated in all acute inflammatory diseases, tuberculosis, organic disease of the heart or brain, cancer and other malignant diseases, aneurysm, and in all cases where stimulation of the circulation is to be avoided.'"]

Dr. G. Adams has published an account of the Arkansas Lithia Spring (*Therapeutic Gazette*, 1889, v, p. 13), situated near Hope, Hampstead County. An analysis showed that each imperial gallon contained 75·86 grains,

including sodium chloride, 24·16; lithium chloride, 3·63; magnesium sulphate, 11·97; and iron oxide, 4·55 grains. The water had a diuretic and laxative effect. There was no accommodation for patients.

There are saline springs at Blanchard Springs, in Union County; saline and chalybeate springs at Blood Spring, in Montgomery County; sulphuretted saline springs near Dardanelle; sulphuretted springs at Gum Springs, in Cleveland County, at Pennywits Sulphur Springs, in Crawford County, and at White Sulphur Springs, near Pine Bluff. There are chalybeate springs at Mount Nebo Springs, near Dardanelle. There are calcic springs at Eureka Springs, in Carroll County, the water of which contains but 5·85 grains of solids, including 4·43 grains of calcium bicarbonate in each gallon, and at Mountain Valley Springs, near Hot Springs, the water of which contains 21·82 grains of solids, 12·66 grains of which are calcium bicarbonate, in a gallon. Except at Eureka Springs, the accommodations are primitive.

California has probably a larger number of mineral springs, more of which are improved as resorts, than any other State. As is the case in most regions where there are evidences of volcanic action, there are many thermal springs, some of which are popular resorts. There are alkaline carbonated springs at Adams Spring, in Lake County, which have proved of value in *chronic dyspepsia*, *hepatic congestion*, and *rheumatism;* Ætna Springs, in Napa County; Allen Springs, in Lake County; California Seltzer Spring, in Mendocino County; Fry's Soda Spring, in Siskiyou County; Glen Alpine Mineral Springs, in El Dorado County; Litton's Seltzer Spring, in Sonoma County; Summit Soda Springs, in Alpine County; Tolenas Spring, in Solano County; and Vichy Springs, in Santa Clara County. There are sulphuretted-saline springs at Alum Rock Springs, in Santa Clara County; Byron Springs, in Contra Costa County; El Paso de Robles Springs (hot and cold), in San Luis Obispo County; on Pluton Creek, in Sonoma County; Harbin Springs and Mill's Mineral Springs (hot), in Lake County; and Tuscan or Lick Springs, in Tehama County. There are sulphuretted-chalybeate springs at Bonanza Springs, in Lake County; El Paso de Robles Springs, in San Luis Obispo County; Mark West Springs, in Sonoma County; and Witter's Springs, in Lake County. There are alkaline-sulphuretted springs at Castalian Mineral Wells, in Inyo County, and Pearson's Springs, in Lake County. The alkaline and saline springs are Bartlett Springs, in Lake County. The alkaline springs are Geyser Springs, in Sonoma County, and Highland Springs, in Lake County. There are sulphuretted springs at Fulton Wells, in Los Angeles County; Hot Mud Springs, in Siskiyou County; Monticello Hot Springs, Mountain Glen Springs, and Las Cruces Hot Springs, in Santa Barbara County; Matilija Hot Springs, in Ventura County; Newsom's Arroyo Grande Warm Springs, in San Luis Obispo County; Simmon's Hot Sulphur Springs, in Colusa County; Warner's Ranch Springs, in San Diego County; St. Helena Springs, in Napa County; and Wilbur Springs, in Colusa County.

Colorado includes within its territory both warm and cold springs, the waters of which are rich in various constituents. Among the most celebrated of these springs are the six springs at Manitou, a beautifully situated town at the foot of Pike's Peak. An analysis of the water by Oscar Loew, in 1875, showed the following ingredients:

CONSTITUENTS.	MANITOU SPRINGS.					
	Iron Ute Spring.	Little Chief Spring.	Manitou Spring.	Navajo Spring.	Ute Soda Spring.	Shoshone Spring.
	Parts in 100,000.	Parts in 100,000.	Parts in 100,000.	Parts in 100,000.	Parts in 100,000.	Parts in 100,000.
Sodium carbonate	59·34	15·16	52·26	124·69	23·82	88·80
Calcium carbonate	59·04	75·20	111·00	129·40	40·00	108·50
Magnesium carbonate	14·56	13·01	20·51	31·66	6·10	
Lithium carbonate	trace	trace	0·21	0·24	trace	trace
Iron carbonate	5·78	1·80	trace	.....	1·40	.....
Sodium sulphate	30·86	51·88	19·71	18·42	12·24	37·08
Potassium sulphate	7·01	6·24	13·35	16·21	trace	5·12
Sodium chloride	31·59	47·97	40·95	39·78	13·93	42·12
Silica	2·69	2·22	2·01	1·47	trace	trace
Total	210·87	213·48	260·00	361·87	97·49	281·62

All the waters contain free carbonic acid in large quantities.

Dr. S. Edwin Solly (*Manitou, Colorado, U. S. A. Its Mineral Waters and Climate*) recommends the administration of the water of the Navajoe spring in *catarrhs*, *hepatic* or *renal plethora*, *gout*, *gravel*, *gastric catarrh*, *intestinal catarrh*, *pyrosis* associated with *chronic dyspepsia*, and *gastric irritability* in incipient or threatened phthisis. He has found this water useful externally in skin diseases in which *pruritus* or *excoriation of the epidermis* is a prominent feature, and as an injection it relieves intractable *leucorrhœa*. He considers the Shoshone water useful in *gallstones*, *hæmorrhoids*, *jaundice*, and *dyspepsia of hepatic origin*. The Little Chief water is advised in those diseases in which the administration of iron is indicated. The Iron Ute spring is recommended for the treatment of *anæmia* caused by parturition or prolonged lactation, in *amenorrhœa* and *menorrhagia* of hæmic origin, in *gastric* and *intestinal atony*, and in *functional neuroses*.

At Glenwood there is the Yampah spring. An analysis of the water by Professor Chandler

showed the following constituents in each gallon:

Chloride of sodium	1089·8307 grains.
Chloride of magnesium	13·0994 "
Bromide of sodium	0·5635 grain.
Iodide of sodium	trace
Fluoride of calcium	"
Sulphate of potassium	24·0434 grains.
Sulphate of calcium	82·3861 "
Bicarbonate of lithium	0·2209 grain.
Bicarbonate of magnesium	13·5532 grains.
Bicarbonate of calcium	24·3727 "
Bicarbonate of iron	trace
Phosphate of sodium	"
Biborate of sodium	"
Alumina	"
Silica	1·9712 grains.
Organic matter	trace
Total	1250·0411 grains.

Dr. J. C. Blickensderfer, of Denver, has found that the external and internal use of these waters is of value in *Bright's disease*, *rheumatism*, *hepatic diseases*, *syphilis*, and various *skin diseases*. Dr. Lewis R. Morris (*New York Medical Journal*, September 28, 1895) states that a glass or more of the water, either hot or cold, taken in the morning before breakfast, seems to increase the appetite and relieve the nausea in *dyspepsia* and *gastric catarrh*. In *chronic catarrhal gastro-enteritis*, in *constipation*, in *saturnism*, and in *rheumatoid arthritis* Dr. Morris has found these waters useful. The Siloam springs, in Garfield County, have an outflow of water varying in temperature from 94° to 104° F., and containing 616·5 grains of salts, principally sodium chloride and calcium sulphate, in each gallon. It is stated that the waters act like those of Glenwood, but there are no such luxurious accommodations as exist at the latter place.

In Cañon City there are several springs of therapeutic value. Dr. F. R. Blake (*St. Louis Courier of Medicine*, 1881, vol. vi, p. 178) states that the waters are palatable, though they purge if taken in large quantities. They act on the liver and kidneys, and he has found them especially useful in *biliary obstruction*. The hot springs are used for baths. Professor Loew gives an analysis of the waters in the following table:

CONSTITUENTS.	CAÑON CITY SPRINGS.					
	Iron Duke.	Little Duke.	Big Ute.	Aqua Vide.	Congress Spring.	Hot Spring.
	Parts in 100,000.	Parts in 100,000.	Parts in 100,000.	Parts in 100,000.	Parts in 100,000.	Parts in 100,000.
Sodium carbonate	12·67	12·66	5·94	12·58	3·32	1·19
Calcium carbonate	5·35	3·74	7·32	6·78	4·82	5·53
Magnesium carbonate	2·49	2·34	2·57	3·02	3·00	2·11
Sodium sulphate	2·01	2·07	2·80	2·49	3·10	1·34
Sodium chloride	13·72	19·56	22·58	20·70	6·52	3·01
Total	36·26	40·40	41·22	45·59	20·63	13·20

There are no mineral springs of importance in *Connecticut*, although some weak chalybeate and sulphuretted springs possess a local reputation, while springs once used as resorts are now neglected. There are sulphuretted springs at Lebanon, in New London County, and at Suffield, in Hartford County. There are chalybeate springs at North Woodstock, in Windham County; at Oxford and North Haven, in New Haven County; and at Stafford Springs, in Tolland County. The facilities of travel afford the residents of this State opportunity to visit springs where water more heavily impregnated with mineral substances may be obtained.

There are no mineral springs of importance in *Delaware*, although water that is mildly chalybeate is found in several parts of the State.

Florida is rich in springs that contain hydrogen sulphide, and the presence of that gas is an objection to the water that is obtained from the artesian wells. As a rule, the waters contain but small percentages of mineral substances. There are sulphuretted springs at Orange City and Enterprise (De Barry Springs), in Volusia County; at Clay Spring, near Apopka, and at Hoosier Spring, near Altamonte Station, in Orange County; at Tarpon Springs, in Hillsborough County; and at White Springs, in Hamilton County. There are chalybeate springs at Newport Sulphur Springs, near Saint Mark's, in Wakulla County, and at Wesson's Iron Springs, in Hamilton County. The accommodations at some of these places are primitive, but the waters may be employed as adjuncts to the mild climate.

Georgia contains a number of mineral springs, several of which have been improved so that the resorts are satisfactory. There are carburetted chalybeate springs in Fulton County, near Atlanta, the Augier's Mineral Springs. The sulphuretted chalybeate springs are Camp's Spring, near Atlanta, in Fulton County; Beall Spring, in Warren County; the Chalybeate Springs, Warm Springs, and White Sulphur Springs, in Meriwether County; Magnolia Spring, in Sumter County; Powder Springs, in Cobb County; and Watson's Springs, in Greene County. There are saline, calcic, chalybeate, and sulphuretted waters at Catoosa Springs, in Catoosa County; at Cohutta Springs, in Murray County; at Ferrolithic Springs, in Clarke County; at Garnet Springs, near Toccoa, in Habersham County; at Gordon Springs, in Whitfield County; and at Lawrence Mineral Springs, in Chattooga County. There is a small sulphuretted-saline spring at Indian Springs, in Butts County. Among the best springs in the State are the Bowden Lithia Springs, in Fulton County.

These springs contain the following constituents:

	Bromine Lithia Springs.	Lithia Spring.
	Grains per gal.	Grains per gal.
Calcium bicarbonate	17·24	14·18
Magnesium bicarbonate	2·87	10·32
Magnesium sulphate	.....	4·40
Lithium bicarbonate	4·44	2·84
Ferrous bicarbonate	0·21	0·21
Sodium chloride	121·78	133·70
Sodium sulphate	8·03	16·25
Potassium sulphate	1·46	.....
Aluminum sulphate	0·53	1·32
Strontium sulphate	1·22	1·02
Calcium sulphate	12·15	.....
Calcium phosphate	.....	0·63
Magnesium bromide	1·73	1·69
Silicic acid	1·26	1·12
Potassium bicarbonate	.....	3·63
Iodine	trace	trace
Fluorine	.....	trace
Manganese	trace	trace
Rubidium	trace	.....
Boric acid	trace	.....
Phosphoric acid	trace	.....
Total	172·92	191·31

Dr. T. S. Hopkins (*Climatologist*, 1891, vol. i, p. 97) says that these waters are useful in the treatment of *lithiasis*, *uricæmia*, *chronic cystitis*, *diabetes mellitus*, *cystitis*, *prostatitis*, *gleet*, *dyspepsia*, *gout*, *neurasthenia*, and *hepatic derangements*.

When the geological formation of *Idaho* is recalled, the presence of hot springs there would be expected. While many of the hot springs of that State are likely to be used for medicinal purposes in the future, few of them are improved at present. In Owyhee County there are the Bruneau Hot Spring, in Bruneau Valley, and Given's Hot Spring, near Reynolds. East of Boise City, in Ada County, there are warm and hot alkaline, chalybeate, and sulphuretted springs. There are hot sulphuretted springs southwest of Idaho City, in Boise County, and near the Snake River, in Oneida County. The Soda Springs, at the bend of Bear River, in Oneida County, supply carbonated, calcareous, and chalybeate waters.

There are a number of springs in *Illinois* that contain small quantities of mineral ingredients, but few of them are of even local importance. There are carbonated calcic springs at Alcyone Springs, in Cook County, which contain some 44 grains of solids, principally calcium and magnesium bicarbonates, to the gallon, and Zonian Spring, in Kane County, which contains 15 grains of solids to the gallon. The Ganymede Spring, in Ogle County, contains 20 grains, principally calcium and magnesium carbonates, of salts in each gallon. There are saline and chalybeate springs at Green Lawn Springs, Mount Vernon, in Jefferson County, and Perry Springs, in Pike County. The waters of the Glen Flora Springs, near Waukegan, in Pike County, contain magnesium, sodium, and calcium bicarbonates in small quantities, the total salts being less than 40 grains to the gallon. There is a chalybeate spring in Schuyler County that contains a large percentage of iron. There are a number of sulphuretted springs in various parts of the State.

Indiana contains within its borders a number of mineral springs, the sulphuretted and chalybeate waters being most numerous. There are chalybeate springs at Anderson Spring, at Hartsville Spring, and near Azalia, in Bartholomew County; at Anderson Mound Spring (carbonated), in Madison County; at Central Springs, near Shoals, in Martin County; at Milburn Springs, in Pike County; and at Van Cleave Springs, in Crawfordsville, Montgomery County. There are chalybeate and saline springs at De Gonia Springs, in Warren County, the water of which is carbonated and contains 121 grains of solids, principally magnesium, potassium, and sodium sulphates and calcium and iron carbonates, in each gallon. Hawkins's Chalybeate Springs, in Richmond, Wayne County, has a carbonated water that contains about thirty grains of solids, principally calcium bicarbonate and sulphate, in each gallon. The sulphuretted saline springs are Hosea Saline Sulphur Spring, in Clarke County, the waters of which contain 897·29 grains of solids, including sodium sulphate (393·76 grains), calcium sulphate (221·42 grains), potassium sulphate (111·25 grains), calcium carbonate (88·20 grains), and sodium chloride (59·66 grains), to the gallon; La Fayette Artesian Well, in Tippecanoe County, a carbonated sulphuretted water containing 419·54 grains of solids, principally sodium chloride (324·77 grains) and calcium sulphate (56·01 grains), to the gallon; Lodi Artesian Well, in Fountain County, the water of which contains 672·45 grains of solids, principally sodium chloride (502·46 grains), calcium sulphate (55·56 grains), and magnesium chloride (53·54 grains), to the gallon; Trinity Springs, in Martin County, the water of which contains 32·08 grains of solids to the gallon; Wyandotte Spring, in Crawford County, the water of which contains 50 grains of solids to the gallon; and French Lick Springs, in Orange County, where the waters are carbonated and sulphuretted and average between 250 and 350 grains of solids to the gallon, the principal salts being sodium chloride, calcium and magnesium sulphates, and calcium, magnesium, and sodium carbonates.

Iowa has no mineral springs of special importance. Chamberlain, or Storm Lake, Mineral Springs, in Buena Vista County, is an acidulated water that contains some 50 grains of solids, principally lime and magnesia, in each gallon; Colfax Mineral Springs, in Jasper County, are carbonated saline chalybeate waters which contain some 140 grains of solids, principally sodium, magnesium, and calcium sulphates, to the gallon. The Iowa Acid Spring, at Eddyville, in Wapello County, contains 408·99 grains of sulphuric acid, 226·41 grains of alumina, 97·3 grains of iron sulphate, 44·65 grains of calcium sulphate, and small amounts of some other salts, to the gallon. There is a small alkaline-saline spring at Ottumwa, in Wapello County, the water of which contains 200 grains of sodium sulphate in each gallon.

In *Kansas* there are some wells that furnish ferruginous, saline, and sulpho-saline waters, several of which enjoy considerable local reputation. There are carbonated saline-chalybeate springs at Arrington, in Atchison County.

There are chlorinated springs at Geuda Springs, in Sumner County; at Cawker City (Great Spirit Spring), in Mitchell County; at Girard, in Crawford County; and at Iola, in Allen County. There are chalybeate springs at Louisville, in Pottawatomie County, and at Baxter Springs, in Cherokee County.

Kentucky is well known on account of several of its mineral springs, and in those counties where there are the Silurian and Carboniferous formations it is impossible to bore an artesian well without striking underground sources of some kind of mineral water. The sulphuretted springs include Allen Springs, in Warren County; Buffalo Springs, in Breckinridge County; Fox Springs, in Fleming County; Grayson Springs, in Grayson County; Hardin Springs, in Hardin County; Salubrian Springs, in Christian County; and Young's Springs, in Bath County. The sulphuretted and chlorinated springs include Beachville Springs, in Metcalfe County; Big Bone Lick Springs, in Boone County; Blue Lick Spring in Nicholas County; Campbellsville Sulphur Spring, in Taylor County; Drennon Springs, in Henry County; Elliston's Sulphur Spring, in Madison County; Estill Springs, in Estill County; Latonia Springs, in Kenton County; Olympian Springs, in Bath County; Paroquet Springs, in Bullitt County; and Sabree Springs, in Webster County. The saline springs include Bedford Springs, in Trimble County; the lower Blue Lick Spring, in Nicholas County; Cerulean Springs, in Trigg County; Harrodsburg Springs, in Mercer County; Rochester Springs, in Boyle County; Tar Springs, in Breckinridge County; and Yates Mineral Spring, in Boyle County. The principal chalybeate springs are Bryant's Springs, in Lincoln County; Burgher's Spring, in Logan County; Davis Spring, in Hopkins County; Dripping Springs, in Garrard County; Esculapia Springs, in Lewis County; Hickman's Springs, in Daviess County; Howell Mineral Springs, in Hardin County; and Rockcastle Springs, in Pulaski County.

Louisiana has no mineral springs of any particular importance. There are chalybeate springs at Abita Spring and at Claiborne Springs, both near Covington, in Saint Tammany Parish; they were popular resorts prior to the civil war, and still have some vogue with the residents of New Orleans. There is a sulphur spring at White Sulphur Springs, in Catahoula Parish.

Maine contains mineral springs that supply waters of most of the different classes, except the thermal. Few of the springs are strongly impregnated with salts or gases. Alkaline, calcic waters are supplied by the Addison Mineral Spring, in Washington County; the American Chalybeate Spring and the Auburn Mineral Spring, at South Auburn, and the Lake Auburn Mineral Spring, at North Auburn, in Androscoggin County; the Poland Spring, at South Poland, in Androscoggin County; and the Rosicrucian Spring, in Lincoln County. Sulphuretted water is supplied by the Bethel Spring, in Oxford County; Boothbay Medicinal Mineral Spring, in Lincoln County; and Katahdin Mineral Spring, in Piscataquis County. There are saline springs at Hartford Cold Springs, in Oxford County; and at Lubec Saline Springs, in Washington County. The Poland Spring is the best known of the Maine springs. The water contains about 3·75 grains of solids to the gallon, principally calcium carbonate and silica. The Paradise Spring, near Brunswick, in Cumberland County, is a purer water, as it contains less than a grain of salts to the gallon, sodium carbonate and silica being the chief constituents.

Maryland contains a number of springs the waters of which are impregnated with small quantities of mineral ingredients. None of them is of much importance, and several that were formerly used as resorts have been virtually abandoned. There are mild chalybeate springs at Bentley's Springs, in Baltimore County; at River Springs, in St. Mary's County; and at Spa Spring, in Prince George's County. There is an alkaline, calcic, carbonated spring, the Strontia Mineral Spring, at Brooklandville, in Baltimore County. The water contains 1·86 part of strontium bicarbonate in 100,000 parts.

Massachusetts has no mineral springs that possess anything more than local importance; the waters contain but small proportions of mineral ingredients. Alkaline calcic waters are obtained from the Allandale Springs, West Roxbury, in Suffolk County; Bethlehem Spring, near Braggville, in Worcester County; and the Commonwealth Mineral Spring, Waltham, in Middlesex County. Mild chalybeate waters are supplied by the Crystal Mineral Springs, at Stoneham, in Middlesex County; Coldbrook Mineral Springs, in Worcester County; and Hopkinton Springs, in Middlesex County.

Michigan contains but few natural mineral springs, but in boring artesian wells a variety of mineral waters has been obtained. A number of these wells have been referred to as magnetic; in no instance, it is credibly stated, has the water itself any magnetic properties, the magnetic phenomena being manifested in the vicinity of the springs. Alkaline calcic waters are obtained from the Eaton Rapids Magnetic Springs and the Grand Ledge Magnetic Wells, in Eaton County; the Leslie Magnetic Wells, in Ingham County; the St. Louis Magnetic Spring, in Gratiot County; the Hubbardston Magnetic Spring, in Ionia County; the Shawnee Mineral Springs, in Monroe County; and Butterworth's Magnetic Spring, at Grand Rapids, in Kent County. Sulphuretted water is supplied by the Alpena Magnetic Well, in Alpena County; Owen's Mineral Well, at Ypsilanti, in Washtenaw County; and the Wyandotte White Sulphur Spring, in Wayne County. Saline waters are supplied by the Fruitport Artesian and Magnetic Well, in Muskegon County; the Lansing Magnetic Well, in Ingham County; the Midland Magnetic Well, in Midland County; the Spring Lake Magnetic Well, in Ottawa County; and the Ypsilanti Mineral Well, in Washtenaw County. The principal chlorinated waters are those of Mount Clemens Mineral Springs (sulphuretted), which contain from 9,000 to 11,000 grains of salts, principally sodium chloride, in each gal-

lon; and the Saint Clair Mineral Springs, in Saint Clair County.

Minnesota mineral springs are comparatively unimportant. There are alkaline calcic springs at Inglewood Springs, near Minneapolis, and at Owatonna Mineral Springs, in Steele County.

Mississippi contains a number of mineral springs that supply almost all kinds of waters except the thermal. There are chalybeate springs near Camden, in Madison County; near Aberdeen, in Monroe County; near Granada, in Granada County; near Holly Springs, in Marshall County; at Ocean Springs, in Jackson County; and near Columbia, in Marion County. The water of Lauderdale Spring, in Lauderdale County, and of Castalian Springs, in Holmes County, is chalybeate and sulphuretted. Saline waters are supplied by Cooper's Well, near Raymond, in Hinds County, and La Fayette Springs, in La Fayette County.

An analysis by J. Lawrence Smith shows that each gallon of water from Cooper's Well contains—

	Grains.
Sodium sulphate	11·71
Potassium sulphate	0·61
Calcium sulphate	32·13
Aluminum sulphate	6·12
Magnesium sulphate	23·28
Sodium chloride	8·36
Calcium chloride	4·32
Magnesium chloride	3·48
Iron peroxide	3·36
Calcium crenate	0·31
Silicon crenate	1·80
Total	95·48

The late Dr. Joseph Jones (*Times and Register*, 1892, vol. xxv, p. 395) found that this water was *purgative*, *diuretic*, *diaphoretic*, and *alterative*. He recommended the water in cases of *anasarca*, *ascites*, whether of cardiac, hepatic, or renal origin, acute and chronic *alcoholism*, *Bright's disease*, uratic or oxalic *calculus*, *jaundice*, whether due to portal derangement or to paludism, *gout*, *paludal toxæmia*, *chronic diarrhœa*, *chronic constipation*, *dyspepsia*, and *neurasthenia*.

Missouri has saline springs in Milford, in Barton County; in Climax, in Camden County; in Elk Lick Springs, in Pike County; near Crescent Hill, in Bates County; and at Reiger Spring, in Mercer County. There are sulphuretted saline springs near Marshall, in Saline County, and at Rocheport, in Boone County. There are chlorinated and chalybeate springs at Aurora Springs, in Miller County; at Cedar Springs, in Cedar County; at Choteau Springs, in Cooper County; and at Zodiac Springs, in Vernon County. There are saline and chalybeate springs at Bowsher Mineral Springs, in Mercer County; at Bratton Spring, near Columbia, in Boone County; at Landreth's Mineral Well, near Knox City, in Knox County; at Paris Chalybeate Springs, in Lawrence County; and at Spaulding Springs, in Ralls County. There are chalybeate springs at Cedar Springs, in Cedar County; at Eldorado Springs, in Oregon County; at Fairview Mineral Springs, in Worth County; and at McAllister Springs, in Saline County. There are chlorinated springs at Boonesborough, in Howard County; at Harriman's Sulphur Springs, in Cooper County; at Lewis Springs, near Glasgow, in Howard County; and at Sweet Springs, near Huntsville, in Randolph County. There are sulphuretted and chlorinated springs at Montesano Springs, in Jefferson County, and at Nevada Mineral Springs, in Vernon County. There are alkaline saline springs at Siloam Springs, in Howell County.

Montana contains a number of important springs, but very few of them have been improved. Probably the thermal springs will prove important; those now used are the Alhambra Springs, at Clancy, in Jefferson County; Allan's Mineral Springs, in Bitter Root Valley, in Missoula County; Big Hole Hot Springs, in Beaver Head County; Boulder Hot Spring, in Jefferson County; Clark's Warm Springs and Puller's Springs, in Madison County; Helena Hot Springs, in Lewis and Clarke County; Hunter's Hot Springs and Matthews's Warm Springs, in Gallatin County; Ryan's Hot Springs, in Beaver Head County; and White Sulphur Springs, in Meagher County. All of these waters contain mineral ingredients. In Yellowstone Valley, near Mill Creek, in Gallatin County, there is the Apollinaris Spring that supplies a delightful water, more palatable to the writer's taste than the imported Apollinaris.

Nebraska has no mineral springs of any importance. The waters of some of the artesian wells contain saline ingredients, but none of them is of medicinal value.

Nevada, in consequence of its sparseness of population, has had but little improvement of its mineral springs, which include hot and cold waters. There are hot springs at Elko, in Elko County; near Carson City, in Ormsby County; at Wellington, in Lyon County; at Steamboat, in Washoe County; at Genoa, in Douglas County; and in Pine Valley, in Eureka County. There are sulphuretted springs north of Columbus, in Esmeralda County; near Mineral Hill, in Eureka County; and at Golconda, in Humboldt County. It is likely that within a few years several other springs in this State will be improved so as to be used as resorts.

Most of the mineral springs of *New Hampshire* have but local reputation, and their waters contain but a small proportion of mineral ingredients. There is an alkaline spring at Conway, in Carroll County, the water of which contains but 2 grains of solids to the gallon. There is a carbonated chlorinated spring at Bradford, in Merrimack County. There is a calcic spring at Birchdale Springs, near Concord, in Merrimack County. There are chalybeate springs at Charlestown and East Unity, in Sullivan County; at Milford, Amherst, and Goffstown Centre, in Hillsborough County; and at Moultonborough, in Carroll County. There is also the Londonderry lithia spring at Nashua, in Hillsborough County.

New Jersey has no mineral spring of importance. At Schooley's Mountain, in Morris County, there is a chalybeate spring, the water of which contains a little more than half a

grain of iron carbonate in each gallon. Several artesian wells in the State supply water that contains mineral substances.

New Mexico has a number of mineral springs, some of which have been used for medicinal purposes since the time of the Spanish occupation. There are saline chlorinated hot springs near Las Vegas, in San Miguel County; near Barranca, in Taos County; near Mimbres, in Grant County; near Jemes, in Bernalillo County; and near Rio Pajarito, in Taos County. The Aztec Spring, near Santa Fé, supplies a pleasant alkaline water. The Jemes Hot Springs, in Bernalillo County, yield alkaline chlorinated waters.

New York State has been noted for the character of its mineral springs for more than a hundred years, the famous Saratoga Springs having been a resort since the latter portion of the eighteenth century. In part, the notoriety of the various springs has been due to the facts that the State was well populated, and the facilities for reaching the various spas were better than those afforded by other States as far as local springs were concerned. There are virtually no thermal springs, the Lebanon springs having an average temperature of 75° F., and therefore being scarcely eligible for admission to the list of such springs.

There are chalybeate springs at Whitehall, in Washington County, and at Lebanon Springs, in Columbia County. There are chalybeate and sulphuretted springs near Dryden, in Tompkins County, and at Richfield Springs, in Otsego County. The Oak Orchard Acid Springs, at Alabama, in Genesee County, are acid and chalybeate.

Dr. I. Ott has made a careful investigation of the physiological action of Congress water (*Medical Times*, 1871, vol. i, p. 352), and found that when that water is ingested the excreta are increased and the intestinal excretion and insensible perspiration are diminished, while the urinary excretion is increased. In the latter the amount of urea, of sodium chloride, and of sulphuric acid is increased, and the amount of uric acid lessened; the amount of phosphoric acid is little altered, but more of it is united in earthy salts than when this water is not taken.

The carbonated chlorinated waters are those of Ballston Spa Springs at Ballston, in Saratoga County.

CONSTITUENTS.	BALLSTON SPA SPRINGS.		
	Artesian Lithia Spring.	Franklin Artesian Well.	Washington Lithia Well (Old Conde Dentonian).
Solids.	Grains to the gallon.	Grains to the gallon.	Grains to the gallon.
Sodium bicarbonate	11·93	94·60	34·40
Calcium bicarbonate	238·16	202·33	173·48
Magnesium bicarbonate	180·60	177·87	158·35
Strontium bicarbonate	0·87	trace	0·19
Lithium bicarbonate	7·75	6·78	15·51
Iron bicarbonate	1·58	1·61	2·30
Barium bicarbonate	3·88	1·23	4·74
Potassium sulphate	0·52	0·76	.....
Sodium phosphate	0·05	0·01	trace
Sodium biborate	trace	trace	trace
Sodium chloride	750·03	659·34	645·48
Potassium chloride	33·28	33·93	9·23
Sodium bromide	3·64	4·67	2·37
Calcium fluoride	trace	trace	trace
Sodium iodide	0·12	0·24	0·22
Alumina	0·08	0·26	0·40
Silica	0·76	0·74	1·03
Organic matter	trace	trace	trace
Total	1,223·25	1,184·37	1,047·70
Gases.			
Carbonic acid	426·114	460·066	358·345

The foregoing table gives the analysis of these waters made by Professor C. F. Chandler. Next to those of Saratoga, these are probably the most popular springs in the State. There is a carbonated chlorinated spring at South Argyle, in Washington County, that is a local resort. But the most famous of the waters of this class are those of the Saratoga Springs, Professor Chandler's analyses of some of which are given herewith:

CONSTITUENTS.	Champion Spouting Springs.	Congress Spring.	Empire Spring.	Flat Rock Spring.	Geyser Spouting Spring.	Hathorn Spring.	High Rock Spring.	Pavilion Spring.	Seltzer Spring.	United States Spring.	Vichy Spring.
Solids.	Gr. to the gal.	Gr. to the gal.	Gr. to the gal.	Gr. to the gal.	Gr. to the gal.	Gr. to the gal.	Gr. to the gal.	Gr. to the gal.	Gr. to the gal.	Gr. to the gal.	Gr. to the gal.
Sodium bicarbonate	17·62	10·77	9·02	9·10	71·23	4·29	34·89	2·76	29·43	4·67	82·87
Calcium bicarbonate	227·07	143·40	109·66	98·63	168·39	170·65	131·74	120·17	89·87	93·12	95·52
Magnesium bicarbonate	193·91	121·76	42·96	29·47	149·34	176·46	54·92	76·27	40·34	72·88	41·50
Strontium bicarbonate	0·08	trace	trace	0·01	0·43	trace	trace	trace	trace	0·02	trace
Lithium bicarbonate	6·25	4·76	2·08	3·23	9·00	11·45	.....	9·49	0·90	4·85	1·76
Iron bicarbonate	0·65	0·34	0·79	0·09	0·98	1·13	1·48	2·57	1·70	0·97	0·05
Barium bicarbonate	2·08	0·93	0·07	0·10	2·01	1·74	trace	0·88	trace	0·91	0·59
Potassium sulphate	0·25	0·89	2·77	0·48	0·32	.....	1·61	2·02	0·56	.....	trace
Sodium phosphate	0·01	0·02	0·02	0·04	trace	trace	.....	trace	trace	0·02	trace
Sodium biborate	trace	trace	trace	trace	trace	trace	.....	trace	trace	trace	trace
Sodium chloride	702·24	400·44	506·63	108·85	562·08	509·97	390·13	459·90	134·29	141·87	128·69
Potassium chloride	40·45	8·05	4·29	7·99	24·64	9·60	8·50	7·66	1·34	8·62	14·11
Magnesium sulphate	.....	.....	.....	10·83	.....	.....	.....	.....	.....	.....	.....
Sodium bromide	3·58	8·56	0·27	0·32	2·21	1·53	0·73	0·99	0·63	0·84	0·99
Calcium fluoride	trace	trace	trace	.....	trace	trace	trace	trace	trace	trace	trace
Sodium iodide	0·23	0·14	trace	0·01	0·25	0·19	0·08	0·07	0·03	0·05	trace
Alumina	0·46	trace	0·42	0·04	trace	0·13	1·22	0·33	0·37	0·09	0·48
Silica	0·70	0·84	1·46	1·34	0·66	1·26	2·26	3·16	2·56	0·19	0·76
Organic matter	trace	.....	trace	trace	trace	trace	trace	trace	trace	trace	trace
Total	1,195·58	700·90	680·44	270·53	991·54	888·40	627·56	687·28	302·02	331·84	367·32
Gases.											
Carbonic acid	465·46	392·30	344·67	.....	454·08	375·75	409·46	332·46	324·08	245·73	383·07

The most prominent chlorinated alkaline springs are the Sharon Springs in Schoharie County. Dr. G. A. Williams (*Climatologist*, 1891, vol. i, p. 119) has found that the inhalation of atomized Sharon Springs water benefits *coryza*, *chronic nasal catarrh*, *bronchorrhœa*, *acute laryngitis*, *chronic catarrhal laryngitis*, *laryngeal phthisis*, *laryngo-tracheitis*, and *acute bronchitis*. Dr. G. E. Walton, in a monograph on these waters, commends their internal and external use for *rheumatism*, *gout*, *hepatic engorgement*, *gallstones*, *renal congestion*, *cystic catarrh*, *chronic metallic poisoning*, *uterine derangements*, and *skin diseases*. J. G. Pohle's analysis of the waters gave the following results:

CONSTITUENTS.	SHARON SPRINGS.	
	Red Sulphur Spring.	Gardner Magnesia Spring.
Solids.	Grains to the gallon.	Grains to the gallon.
Sodium bicarbonate	0·49	0·54
Calcium bicarbonate	12·93	9·70
Magnesium bicarbonate	0·69	1·36
Calcium sulphate	96·64	93·50
Magnesium sulphate	18·96	19·68
Sodium chloride	0·33	1·23
Magnesium chloride	0·73	0·44
Calcium chloride	0·07	0·16
Calcium sulphide		
Magnesium sulphide	0·89	0·63
Silica	0·45	0·40
Total	132·18	127·64
Gases.	Cubic inches.	Cubic inches.
Sulphuretted hydrogen	10·50	6·00
Carbonic acid	4·58	2·22
Atmospheric air	4·00	3·00

Sulphuretted waters are obtained at Avon, in Livingston County; at Cairo, in Green County; at Chittenango, in Madison County; and at Clifton Springs, in Ontario County.

There is an alkaline calcic spring at Dansville, in Livingston County.

North Carolina contains almost all varieties of mineral springs. The warm springs in Madison County have a plentiful flow of a carbonated calcic water that has a temperature which varies from 92° to 117° F.; there are excellent accommodations at the place, and it is a deservedly popular resort. There are chalybeate springs at Cowhead Spring, near Washington, in Beaufort County; near Henderson, in Vance County; at Jackson Springs and at Lemon Springs, in Moore County; and at Piedmont Springs, in Stokes County. Chalybeate and sulphuretted waters are obtained at All-Healing Springs, in Gaston County; at Alum Spring, in Onslow County; at Cleveland Mineral Springs, in Cleveland County; at Copal Grove, in Stanley County; and at Piedmont Springs, in Burke County. There are a number of springs that supply carbonated, calcic, or sulphuretted waters; but the localities are virtually unimproved, and accommodations for the treatment of invalids are lacking.

North Dakota has within its territory a number of mineral springs, but all are virtually unimproved.

Ohio contains no very important mineral springs. There are calcic springs at Bellbrook, in Green County; at Castalia, in Erie County; at Delaware, in Delaware County; and at Magnetic Springs, in Union County. There are chalybeate springs at Mineral Springs, in Adams County, and at Wilberforce, in Green County. There are chlorinated alkaline springs south of Cleveland, in Cuyahoga County, and at Stryker Mineral Well, in Williams County. Sulphuretted waters are obtained at Howland Springs, near Warren, in Trumbull County, and near Sandusky, in Wyandot County.

Oregon contains hot and cold mineral springs, but very few of them have been improved so as to make suitable resorts. Among the thermal waters are Belknap Hot Springs (184° F.), near McKinzie Bridge, in Lane County; Canter's Blue Sulphur Springs (200° F.), in Baker County, and Des Chutes Hot Springs (143° F.), in Crook County. There is a chlorinated alkaline water at Wilhoit's Soda Springs, in Clackamas County. There is a number of sulphuretted and carbonated springs that have not been improved.

Pennsylvania is especially rich in chalybeate springs. Chalybeate waters are obtained at Bedford Springs, in Bedford County; at Blossburg Springs, in Tioga County; and at Cresson Springs, in Cambria County. Dr. J. D. Morgan (*Maryland Medical Journal*, 1889, vol. xxi, p. 425) says that the Bedford Spring water is useful in *diseases of the stomach*, *liver*, *kidney*, and *bowels*. He advises that one or two glasses of the magnesia water should be taken on rising in the morning, and a brisk walk taken before breakfast. Just before breakfast, dinner, and supper a small glass should be taken; a little salt may be added to increase the osmotic power of the water, which acts better if heated. Sulphuretted and chalybeate waters are obtained at Doubling Gap, in Cumberland County; at Minnequa Springs, in Bradford County; at Three Springs, in Huntingdon County; and at Loretto, in Cambria County. Gettysburg water, according to Dr. I. Ott (*Medical Times*, 1871, vol. ii, p. 143), increases the daily excretion of urea and of sulphuric acid, and decreases that of uric and phosphoric acids and that of sodium chloride. Dr. John Bell) *Medical and Surgical Reporter*, 1867, vol. xvii, p. 262) reports that it is of value in the treatment of *gout*, *rheumatism*, *diabetes*, *dyspepsia*, and *constipation*. The chief constituents in the waters of the principal springs may be seen from the table at the top of page 382. The analyses were made by F. A. Genth.

Rhode Island contains no mineral springs that are of any importance from a therapeutic standpoint.

South Carolina has no mineral springs the waters of which are other than mediocre in remedial properties. There are mild chalybeate waters at Cherokee Springs, in Spartanburg County, and at Seneca, in Oconee County. There are sulphuretted waters at Chick's Springs, in Greenville County, and at Glenn Springs, in Spartanburg County.

South Dakota contains an excellent hot spring at Hot Springs, in Fall River County. Mineral waters have been obtained from a num-

CONSTITUENTS.	BEDFORD SPRINGS.					CRESSON SPRINGS.		Gettysburg Lithia Spring.
	Sweet Spring.	Magnesia Iron Spring.	Sulphur Spring.	Magnesia Spring.	Large Limestone Spring.	Iron Spring.	Alum Spring.	
	Grains to the gallon.	Grains to the gallon.	Grains to the gallon.	Grains to the gallon.	Grains to the gallon.	Grains to the gallon.	Grains to the gallon.	Grains to the gallon.
Sodium bicarbonate	....	.....	.....	.....	....	.....	.....	3·20
Calcium carbonate	0·52	8·47	10·21	10·43	7·09	3·53	.....	.....
Calcium bicarbonate	....	.....	.....	.....	....	.....	.....	10·71
Magnesium carbonate	0·14	0·59	1·00	0·94	1·88	.....	.....	.....
Magnesium bicarbonate	....	.....	.....	.....	....	....	.....	5·31
Manganese carbonate	....	trace	trace	trace	trace	.....	trace	.....
Iron carbonate	....	0·05	0·08	0·04	0·04	5·04	3·75	.....
Iron bicarbonate	....	.....	.....	.....	....	.....	.....	0·03
Sodium sulphate	....	0·61	0·51	0·33	....	1·64	0·70	.....
Calcium sulphate	....	90·46	73·08	99·83	0·58	48·92	40·20	0·48
Potassium sulphate	....	0·30	0·41	0·18	0·27	0·32	0·43	0·15
Strontium sulphate	....	0·01	.....	0·13	0·08	.....	.....	.....
Magnesium sulphate	....	38·68	33·40	39·62	0·29	22·58	27·70	3·30
Iron sulphate	....	.....	.....	.....	....	23·48	49·64	.....
Calcium phosphate	....	0·02	0·02	0·01	trace	0·03	trace	.....
Sodium chloride	....	0·53	0·37	0·46	0·23	0·04	0·02	0·28
Aluminum sulphate	....	.....	.....	.....	....	1·60	21·20	.....
Lithium chloride	....	trace	trace	trace	....	1·21	1·87	.....
Silica	0·65	0·17	0·54	0·77	0·47	.....	.....	.....
Hydrosulphuric acid	....	0·01	0·08	trace	trace	.....	.....	.....
Carbonic acid	0·31	1·27	2·79	0·56	3·77	.....	.....	.....
Silicic oxide	.....	.....	.....	.....	....	.....	.....	1·78
Total	1·62	141·17	122·49	153·30	14·70	108·39	.....	25·24

ber of artesian wells that have been constructed. There is a spring at Pierre that supplies a chlorinated alkaline water the composition of which resembles that of the waters of St. Catherine, in Canada.

Tennessee contains a number of mineral springs, especially the chalybeate and sulphuretted. There are chalybeate springs at Beersheba Springs, in Grundy County; at Bon Air Springs, near Sparta, in White County; near Williamsburg, in McMinn County; near Elkton, in Giles County; near Erwin, in Unicoi County; near Mooresburg, in Hawkins County; at Howard Springs, in Cumberland County; near Erie, in London County; and at Robinson Spring, in Van Buren County. Chalybeate and sulphuretted waters may be obtained at Alleghany and Blount Springs, near Maryville, and at Montvale, in Blount County; at Black Water Springs, in Granger County; near Dandridge, in Jefferson County; at Bloomington, in Putnam County; near Bolivar, in Hardeman County; at Epperson Springs, in Macon County; near Rogersville, in Hawkins County; at Kingston Springs, in Cheatham County; and at Oliver Springs, in Anderson County. There are sulphuretted waters at Avoca Springs, near Bristol, in Sullivan County; near Dandridge, in Jefferson County; at Beaver Dam Springs, in Hickman County; at Clancy, in Robertson County; near Bean's Station, in Granger County; and near Nashville, in Davidson County.

Texas contains a number of mineral springs, but, as is the case in most of the Southern States, few of them are improved so that they may be used as resorts. A number of so-called mineral springs are artesian wells in which the water contains mineral ingredients. Chalybeate waters are obtained at Dalby Springs, in Bowie County; at Hughes's Spring, in Cass County; and at Hynson's Iron Mountain Springs, near Marshall, in Harrison County. Water containing sulphuric acid is obtained from Sulphur Springs, in Hopkins County, and from the springs near Sour Lake and Luling, in Caldwell County.

Utah has a number of mineral springs, but most of them are undeveloped, especially the hot springs. Near Ogden and Salt Lake City there are hot chlorinated springs that are used for bathing. There are saline, chalybeate, and calcic springs in the State which will be improved, in all likelihood, within a few years.

Vermont has saline sulphuretted springs at Alburgh Springs, in Grand Isle County. There are sulphuretted springs at Barre and Plainfield, in Washington County; near Hartland, in Windsor County; and near Berkshire, in Franklin County. There are sulphuretted springs at Brunswick, in Essex County, and at Newbury, in Orange County. There are carbonated calcic springs at Clarendon, in Rutland County.

Virginia, like New York, includes within its borders some of the most celebrated spas in the United States. One of the more prominent resorts is at Hot Springs, in Bath County, the waters of which have a temperature of from 50° to 110° F., and are saline and calcic in composition. The Warm Sulphur Springs, in the same county, discharge water of a temperature of from 96° to 98° F. The chalybeate springs include Bath Alum Springs, in Bath County; the Bedford Alum Springs, in Campbell County; the Church Hill Alum Springs, in Henrico County; the Clifton Springs, in Alleghany County; Harrison's Mineral Spring, in Tazewell County; Jordan Alum Springs and Rockbridge Alum Springs, in Rockbridge County; Kern's Springs and Shenandoah Alum Springs, in Shenandoah County; the Alum Springs near Ballsville, in Powhatan County; Pulaski Alum Springs, near Dublin, in Pulaski County; Rawley Springs, in Rockingham County; Sharon Springs, in Bland County; Variety Springs, in Augusta County; Washington Springs, in Washington County; and Wytheville Springs,

in Wythe County. Dr. B. Blackford (*Virginia Medical Monthly*, 1877, vol. iv, p. 778) commends the Bedford Alum Springs water in the treatment of *uterine engorgement, chronic leucorrhœa, amenorrhœa, dysmenorrhœa,* and *chronic adenitis*, the water being used internally and as a douche. This use of these waters has been commended by Dr. J. W. Dillard (*Virginia Medical Monthly*, vol. v, p. 718) in *chronic diarrhœa*. Among the more important chalybeate and sulphuretted springs are the Buckingham White Sulphur Springs, in Buckingham County; Hagan's Springs, in Scott County; Huguenot Springs, in Powhatan County; Jordan's White Sulphur Springs, in Frederick County; Millborough Springs, in Bath County; Mungel's Springs, in Washington County; Roanoke Red Sulphur Springs, in Roanoke County; Rock Enon, or Capper's, Springs, in Frederick County; and Valley View Springs, in Shenandoah County. The sulphuretted springs include Botetourt, or Johnson's, Springs, in Roanoke County; Cedar Bluff Sulphur Springs, in Tazewell County; Coyner's Sulphur Springs and Debrell Spring, in Botetourt County; Crystal Sulphur Sprin, in Augusta County; Grayson's Sulphur Springs, in Carroll County; Montgomery White Sulphur Springs, in Montgomery County; and Eggleston Springs, in Giles County. The saline calcic springs include Alleghany Springs and Yellow Sulphur Springs, in Montgomery County; Blue Ridge Springs, in Botetourt County; Healing Springs, in Bath County; and Sweet Chalybeate Springs, in Alleghany County. The alkaline, calcic, and chalybeate springs include the Buffalo Lithia Springs, in Mecklenburg County; the Farmville Lithia Springs, in Prince Edward County; the Orkney Springs, in Shenandoah County; and Wolf Trap Lithia Springs, in Halifax County.

Washington has a number of mineral springs, but, as is the case in all of the more sparsely settled States, most of them are difficult of access and there are no accommodations for visitors. The Cascade Warm Mineral Springs, in Skamania County, supply a warm, saline, sulphuretted water. An alkaline chlorinated water is obtained from Medical Lake, in Spokane County.

West Virginia, like its mother State, Virginia, contains a number of important mineral springs. There are alkaline carbonated springs at Capon Springs, in Hampshire County; and

CONSTITUENTS.	Bedford Alum and Iron Springs.		Farmville Lithia Springs.	BUFFALO LITHIA SPRINGS.		
				Spring No. 1.	Spring No. 2.	Spring No. 3.
Solids.	Grains to the gallon.*	Grains to the gallon.†	Grains to the gallon.‡	Grains to the imp. gallon.§	Grains to the imp. gallon.§	Grains to the imp. gallon.
Calcium bicarbonate	.....	.....	1·33	39·28	14·96	2·52
Magnesium carbonate	.....	.....	....	.....	.....	....
Magnesium bicarbonate	.....	.....	4·49	.....	.....	....
Potassium carbonate	.....	.....	....	.....	29·30	1·85
Lithium bicarbonate	.....	.....	1·99	1·48	2·25	....
Barium bicarbonate	.....	.....	....	.....	1·75	....
Iron carbonate	.....	.....	1·26	.....	.....	....
Iron bicarbonate	.....	.....	....	0·50	0·30	3·77
Sodium sulphate	0·87	.....	3·59	.....	.....	....
Calcium sulphate	4·99	18·67	1·81	19·25	33·07	2·35
Lithium sulphate	0·24	.....	....	.....	.....	....
Magnesium sulphate	12·58	12·66	....	1·53	0·89	0·15
Potassium sulphate	0·71	10·16	0·18	0·46	.....	....
Aluminium sulphate	24·18	7·24	....	8·18	9·07	3·04
Manganese sulphate	0·19	.....	....	.....	.....	....
Iron protosulphate	0·59	23·46	....	.....	.....	....
Iron persulphate	19·26	.....	....	.....	.....	....
Nickel sulphate	0·04	.....	....	.....	.....	....
Cobalt sulphate	0·06	.....	....	.....	.....	....
Copper sulphate	0·06	.....	....	.....	.....	....
Zinc sulphate	0·07	.....	....	.....	.....	....
Magnesium nitrate	0·27	.....	....	.....	.....	....
Ammonium nitrate	0·24	.....	....	.....	.....	....
Calcium phosphate	0·30	.....	....	.....	.....	....
Phosphates	.....	.....	....	.....	.....	....
Sodium silicate	.....	.....	....	.....	.....	....
Sodium chloride	0·23	.....	5·30	1·26	4·92	0·22
Calcium chloride	.....	.....	....	.....	.....	....
Calcium fluoride	trace	.....	....	.....	.....	....
Lithia	.....	.....	....	.....	.....	trace
Alumina	.....	.....	2·52	.....	.....	....
Silica	1·69	.....	3·92	1·72	1·87	0·57
Iodine	.....	.....	trace	trace	trace	....
Phosphoric acid	.....	.....	....	trace	trace	trace
Sulphuric acid	4·02	19·98	trace	.....	.....	....
Organic matter	0·29	.....	trace	trace	trace	trace
Total	70·88	92·17	26·39	73·66	98·38	14·47
Gases.				Cubic inches.	Cubic inches.	Cubic inches.
Carbonic acid	.....	.....	74·2	69·1	59·2	11·6
Sulphuretted hydrogen	.....	.....	....	5·9	8·3	3·4
Oxygen	1·32	.....	....	....	....	....
Nitrogen	3·33	.....	....	....	....	....
Carbon dioxide	6·98	.....	....	....	....	....

* M. B. Hardin, analyst (1877).
† William Gilham, analyst.
‡ E. T. Fristoe, analyst.
§ W. P. Tonry, analyst (1874).

at Mineral Wells, near Parkersburg, in Wood County. There are chlorinated saline waters at Hart Well, near Willow Island, in Pleasants County; at Blue Sulphur Springs, in Greenbrier County; at Borland Mineral Well, in Pleasants County; and at Humphrey's Spring, in Monroe County. The sulphuretted waters include the Floding, or Blue, Sulphur Springs, in Cabell County, and the Gray Sulphur and Red Sulphur Springs, in Monroe County. There are calcic, sulphuretted, and chalybeate waters at Greenbrier White Sulphur Springs, in Greenbrier County, which have been used medicinally since the last century. There are chalybeate springs at Shannondale Springs, near Charlestown, in Jefferson County, and at Spa Springs, in Morgan County.

chiefly to the elimination of waste products that cause intoxication. The internal use of the water produces no effect on the circulatory organs, though the pulse-rate is increased by bathing in it as by any other hot baths. The waters cause a marked increase in the flow of bile, the fæcal discharge, the quantity of urine and the proportion of urinary solids, and the perspiration. These waters are useful in *anæmia* and *debility* due to paludism or self-intoxication, and in diseases due to a defective action of the eliminative organs or to impairment of the excretory functions. Included among these latter are *gout*, *rheumatism*, *chronic paludal poisoning*, *chronic duodenal catarrh*, *catarrh of the bile ducts*, and certain phases of *Bright's disease*. The waters are

CONSTITUENTS.	CAPON SPRINGS.		GREENBRIER WHITE SULPHUR SPRINGS.
	Main Spring.	Beauty Spring.	Name unknown.
Solids.	Gr. to the imp. gal.	Gr. to the imp. gal.*	Gr. to the imp. gal.†
Sodium carbonate	0·59	0·63	....
Calcium carbonate	8·33	8·36	7·07
Magnesium carbonate	1·44	1·27	....
Lithium carbonate	trace	trace	....
Manganese carbonate	trace	trace	....
Iron carbonate	0·04	0·05	....
Copper carbonate	....	trace	....
Calcium sulphate	0·59	0·41	78·35
Magnesium sulphate	....	....	35·42
Potassium sulphate	0·17	0·16	....
Strontium sulphate	trace	trace	....
Nitrates	trace	trace	....
Calcium phosphate	trace	trace	....
Silicates	....	....	3·46
Sodium chloride	0·06	0·05	....
Calcium chloride	....	trace	....
Magnesium chloride	....	....	1·00
Calcium fluoride	trace	trace	....
Alumina	0·02	0·02	....
Silica	0·70	0·67	....
Organic matter	0·20	0·19	4·36
Total	12·14	11·81	129·66
Gases.	Cubic inches.	Cubic inches.	Cubic inches.
Carbonic acid	8·56	7·76	11·28
Sulphuretted hydrogen	....	....	0·24
Oxygen	1·76	1·68	0·48
Nitrogen	3·68	3·68	4·64
Total	14·00	13·12	16·64

* J. W. Mallett, analyst. † A. A. Hayes, analyst.

Dr. J. L. Le Conte (*American Journal of the Medical Sciences*, 1879, vol. i, p. 148) says that the waters of Capon Spring are beneficial for *renal calculi* composed wholly or in part of uric acid, and for cystic deposits of the same substance; the alkalies of the water tend to disintegrate the agglutinating material of the calculi. *Dyspepsia* caused by too free a secretion of acid in the stomach, or due to a gouty diathesis, is also relieved. *Hepatic congestion* and *enlargement* due to derangement of the portal circulation, *functional neuroses* due to *disorders of the sexual organs in women*, and *chlorosis* are benefited by a course at this spa.

The late Dr. W. C. Dabney writes in regard to the Greenbrier White Sulphur Springs (*Gaillard's Medical Journal*, vol. l, 1890, p. 331) that its waters have little or no effect upon the nervous system of healthy persons; the relief from *neuralgia* obtained from their use is due also valuable for persons who have no actual disease, but in whom the liver and bowels are inactive as a result of sedentary habits and over-indulgence in the pleasures of the table.

Wisconsin mineral springs have acquired considerable reputation in the United States. The alkaline calcic waters are obtained from the Arctic Springs, at Galesville, in Trempealeau County; the Bethesda, the Glenn, the Horeb, the Siloam, the Silurian, and the White Rock Springs, at Waukesha; the Gihon Springs, at Delavan, in Walworth County; and the Iodo Magnesian Springs, Beloit, in Rock County. Alkaline-saline waters are obtained from Bristol Soda Springs at Woodworth, in Kenosha County, and the Artesian Mineral Well at Prairie du Chien, in Crawford County. Chalybeate waters are obtained from the Black Earth Mineral Springs, in Dane County; the New Saratoga Springs at Star Prairie, in St. Croix

County; and the Sparta Mineral Wells, in Monroe County.

Wyoming contains within its territory a number of mineral springs, few of which are improved as resorts. The hot springs in Yellowstone Park are not used for therapeutic purposes, but there is a hot spring at Saratoga, in Carbon County, that is a resort.

SAMUEL T. ARMSTRONG.

WAX occurs in two forms, the yellow and white, known respectively as *cera flava* (U. S. Ph., Br. Ph., Ger. Ph.) and *cera alba* (U. S. Ph., Br. Ph., Ger. Ph.). The latter is prepared from the former by its exposure in thin sheets to the sunlight in a moist atmosphere. Their physical properties are essentially the same, but the white variety is preferable on account of its greater freedom from impurities. Having a moderately high melting point, it is employed to impart consistence to the more fluid oils and fats in the preparation of ointments and cerates. It is also used in the preparation of suppositories and medicated bougies in cases where their slow liquefaction is preferable to the more rapid melting which occurs when cacao butter is the principal excipient. Waxed cloth is prepared by saturating cloth with a mixture of 8 parts of white wax, 4 parts of olive oil, and 1 part of turpentine oil. It may be used as a protective, or in the preparation of a blistering plaster.

Internally, wax is practically inert and harmless.

Chinese insect wax, or *Pe la*, is the secretion of a species of *coccus* upon a variety of ash. It may be substituted for the official variety.

Japanese wax is obtained from the fruits of several varieties of *Rhus*, and possesses all the properties of the ordinary kind, but is apt to become rancid.

Myrtle wax is the product of a number of species of *Myrica*. The popular name of the common United States species is bayberry. This wax is obtained by subjecting the fruit to the action of hot water. It is greenish in colour and of an agreeable odour, and may be substituted for the common variety.

RUSSELL H. NEVINS.

WHEAT.—See TRITICUM.

WHEY is the liquid remaining after coagulating and expressing the casein from milk. As the particles of fat are entangled with the casein the two elements are removed together. The following is the composition of ordinary whey, the figures representing percentages: Proteids, 0·82; fat, 0·25; sugar, 4·65; ash, 0·65; water, 92·30. The principal ingredient is, therefore, sugar, the ash being practically unchanged. Whey is prepared by the use of a milk-curdling ferment, essence of pepsin or liquid rennet being commonly used for this purpose. A teaspoonful of either preparation is used to a pint of milk which is kept at a temperature of about 100° F. until coagulation has become complete. The coagulum is then broken up and the whey strained out. For the uses of whey and the "whey cure" the reader is referred to the articles on MILK and DIETETIC TREATMENT.

FLOYD M. CRANDALL.

WHISKY, *spiritus frumenti* (U. S. Ph.), is "an alcoholic liquid obtained by the distillation of the mash of fermented grain (usually of mixtures of corn, wheat, and rye), and at least two years old" (U. S. Ph.). Whisky should be of an amber colour, with a characteristic taste and odour and a slightly acid reaction. The pharmacopœia prescribes that its specific gravity shall not be more than 0·930 or less than 0·914. It should be free from more than mere traces of fusel oil, added sugar, glycerin, and aromatic substances.

Whisky is one of the best of alcoholic stimulants. It is ordinarily preferred to brandy in this country, because of its usual purity and its cheapness. Its tendency to constipate is less than that of brandy. It may be employed in any *sudden collapse of cardiac power* from *syncope*, *hæmorrhage*, or any other cause. Whenever a cardiac stimulant is indicated, whisky may be given by the mouth if possible, hypodermically, or in an enema. In the first and last instances it is best given hot. In *adynamic fevers*, like *typhus* and *typhoid*, the benefits to be derived from a systematic administration of whisky are well known and have been discussed in another article. In cases of *poisoning* by substances which depress the heart, alcohol in the form of whisky is indicated. In *chronic pulmonary tuberculosis* whisky is an almost indispensable medicinal agent, particularly in the last stages of the disease. It is unnecessary to enumerate all the diseases in which whisky may be employed as a rational, proper therapeutic aid. In general it may be said that when cardiac stimulation is required, where general adynamia prevails, when constitutional weakness demands a rapid general stimulant, whisky is indicated.

As an *antiseptic* agent whisky possesses some value, but in its employment for surgical dressings it has long been superseded by other substances.

As to its administration, whisky may be given pure or in combination with other stimulants. In an emergency it may be administered hypodermically—from its proneness to cause abscesses, the injection should always be made deep—or by the rectum. When given in fevers, the quantity must vary with the effects. In the form of eggnog and milk-punch it is agreeable to a convalescent. The usual dose of whisky for an adult is from half an ounce to an ounce.—SAMUEL M. BRICKNER.

WILLOW.—See SALIX.

WINES.—The history of the use of wines begins with antiquity. Throughout the Bible mention is made of the employment of the juice of the grape in religious ceremonies and in social entertainment. The drunkenness of Noah and the prophecy made by Jacob on his deathbed, in which there is a reference to wine, show the great antiquity of the drink. The Hebrews of antiquity drank fermented wine and an artificial wine made from the palm. Ezekiel is authority for the statement that the drinking of wines at festive gatherings was a rare form of entertainment. Moses forbade the priests the drinking of wine or of any intoxi-

cating liquor previous to their entrance to the temple. Hosea praised the peculiar virtues of the wines of Lebanon, although they were not suited for transportation for long distances. The best of these wines is known in Europe at the present time as *vin d'or*. This wine is not fermented in the usual way. Fermentation is induced by placing the grape-juice in clay vessels in the sun. It is said of the *vin d'or* that a few glasses drank at one sitting will produce syncope. The vines of Palestine are still famous for the size and sweetness of their grapes. The ancient Jews had a preference for red wine. The vintage, which lasted from September to November, was celebrated with joyful ceremonies. The mechanism of their wine presses was extremely crude; part of the wine was fermented, part of it drank as must.

The profane writings of antiquity, no less than the sacred, contain multitudinous references to the growth of grapevines, the drinking of wine, and its effects. Despite the testimony of Herodotus to the contrary, it seems to be established that the ancient Egyptians cultivated the vine. The edge of the Nile valley, from Thebes to Memphis, contained soil well adapted to the growth of the grape. Sebennytus is celebrated by Pliny as having produced very fine wine. The ripe grapes were gathered in baskets or hampers, which were carried by men on their heads or by yokes upon their shoulders to the shed, where the pressing of the grapes was accomplished by squeezing in a bag or by treading. According to Genesis (xl, 11), the juice was sometimes drank unfermented: "I took the grapes and pressed them into Pharaoh's cup and I gave the cup into Pharaoh's hand." Usually, however, fermentation was allowed to take place and the wine was kept in hermetically sealed jars of beautiful forms. The light wine was made in Coptos; the heavier wines of good repute were derived from the neighbourhood of Anthylla and Lake Marea.

Drunkenness among the Egyptians was by no means unknown. Men and women alike succumbed to the influence of the wine provided at feasts. On the authority of Herodotus, it is believed by Egyptologists that a guest in an Egyptian household was always served with wine, although it is fair to assume that it was usually drank diluted with water. Drunkenness was a vice in early Egyptian history, and to it must be ascribed the subjugation of the land by hardier races—the Assyrians, the Persians, and the Macedonian Greeks.

Among the Greeks and Romans wine was employed as a drink and as a medicine. Homer mentions many varieties of wine which were celebrated for peculiar properties. He sings of the wines of Phrygia, Epidaurus, Arne, and Thrace; and the products of Cyprus, Chio, and Lesbos were equally celebrated. Horace frequently alludes to the virtues of Chian wine. The Chians are said to have first known the art of the cultivation of the vine, taught by Œnopion, the son of Bacchus. They probably made the first red wine. In some parts of Greece the wine of Lesbos was preferred to all others, because of its sweetness and its delicious flavour. The wines of Naxos, celebrated as being the birthplace of Bacchus, had in ancient times, and still have, high repute. Thasos produced a wine which, though inferior to the other wines, was compared by Pliny to nectar. The Grecks always drank their wine diluted, in the proportion of two fifths wine and three fifths water. The mixing bowl usually stood near the hearth, often on a tripod, and the wine was poured from this into drinking cups. Athenæus quotes from a poet who says that if like parts of water and wine are used, lunacy follows; if the wine is drank pure, paralysis surely results. Herodotus, too, speaks of drinking pure wine as "filling like a Scythian." Homer records several kinds of wine—the red, the sparkling, and the honey-sweet. A special wine seems to have been reserved in honour of elders at feasts (γερούσιον).

The ancient medical writers of Greece and Rome used wine, in one form or another, in almost all diseases. They studied carefully the effects of different kinds of wine upon the system. Thus they recognised that new wine had a tendency to upset the digestion, to promote diuresis, and to interfere with calm sleep. They record that unfermented wine produces colic, flatulence, and diarrhœa. The appearance of headaches and impaired digestion was attributed to sweet wines. Hippocrates recognised the muscular debility which follows the too habitual use of wine, and pointed out the dangers of the sudden cessation of drinking. As cited by Strumpf, Hippocrates also recommended wine in cases of poisoning by opium, aconite, conium, and mushrooms, or whenever a narcotic poison had produced depression. He also used it as an antidote to the bites of venomous serpents, and praises white wine as a diuretic in calculous disorders. Wine was frequently used, on the same authority, as an application to wounds and ulcers. As a stimulant it was used in the algid stages of fevers. In hypercatharsis, flatulence, and diarrhœa it was supposed to act almost as a specific. Galen describes a great many wines; but, like Pliny, gives more contra-indications for their use than reasons for thinking that their employment would be beneficial.

The ancient Arabs possessed wines made from the grape, raisins, figs, dates, honey, and the juice of sweet fruits, as well as from the cocoa and pomegranate. Rhazes (cited in Stillé's *Therapeutics and Materia Medica*, Philadelphia, 1874), speaking of the advantages of wines used moderately, remarks that the complexion and nutrition are thereby improved, that the excretions, particularly that of the urine, are promoted, that the sleep is rendered sound and refreshing, and that the mental faculties are quickened. He says wines should not be taken habitually, but only at intervals of several days. Intoxication he paints in fearful colours. Its repetition, he says, induces disease, headache, paralysis, shaking palsy, and acute affections. Visceral inflammation, abscesses, furuncles, mental weakness, apoplexy, emaciation, and palpitation of the heart are some of the dire things this Arabian physician predicts for the inebriate. He recommends emetics as a reme-

dy for the nausea and headache following a debauch, and advises rest with the use of acid syrups diluted with water or barley water.

Probably every nation or tribe, from the dawn of history and before that time, which possessed any fermentable substance made some kind of wine. And it is altogether likely that, observing the stimulant effect of wine when taken in health, they all used it for medicinal effect whenever it was deemed wise or necessary. Evidence is not lacking on this point in the writings quoted, as well as in those of Strabo, of Galen, of Paulus Ægineta, and of Cicero. Whether or not the Egyptians made use of wines medicinally is not definitely known, but it may be surmised that such was the case from their contact with nations that did. Wine and oil always stood as representing the fertility and the wealth of a country in ancient times; and the fact that "a land flowing with milk and honey" was offered as an inducement to the ancient Jews does not militate against their having had wine, since milk and honey, on competent authority, represented their chief articles of diet. The religious use of wine probably, or possibly, began in a sacrificial way, the fermented juice of the grape being rare and therefore a thing worthy of sacrifice. Its use in the communion service is a heritage of an ancient custom. It is interesting to note that among the ceremonial usages in which wine plays a part is its administration, in the form of palm wine, to a mother among the negroes of Guiana immediately after the birth of her child. In Franconian Switzerland the relatives of a parturient woman take turns in bringing her, during the entire puerperium, a soup of peculiar make which always contains wine. Among the Roman medical writers, Soranus of Ephesus forbade the use of wine early in pregnancy, because he feared an abortion. The Jewish women of ancient times were not allowed to drink wine during their period of pregnancy. The Chinese seem to be more liberal in this respect, permitting their pregnant women to drink anything that has a pleasant taste; but they must not drink to excess anything that is intoxicating or heating to the blood. The Laplanders, during pregnancy, may drink Sarakka wine; but with them this is a religious ceremony, since Sarakka is the goddess who presides over pregnancy and childbirth. The German women of five centuries ago were advised to drink any strong wine, especially claret; but there is no evidence that similar usages prevail to-day (Ploss, *Das Weib*, Leipsic, 1891, vol. ii, pp. 331, 336, 513, 514). Finally, it may be mentioned that wine is used in the performance of some ceremonies of a semi-religious, semi-social nature. In marriages and engagements the drinking of wine is customary among some peoples, being essential to the function. The rite of baptism and that of circumcision are frequently accompanied by the drinking of wine, a white wine being usually chosen for this purpose.

For many hundreds of years the wine industry has been pursued in European countries particularly, although at present American wines are forging their way to the front, and the cultivation of the vine and its subsequent treatment until the perfected product is secured are very thoroughly understood. The grapevine grows luxuriantly in many places, especially in ground rich in the salts of phosphorus and potassium. The manure used is of importance as well, since it is found that the richer the fertilizing agent, the greater is the effect upon the taste of the grape-juice. In Germany and France the dung of cattle is preferred to all other fertilizers, since it is very rich in phosphorus and potassium. The finer wines, such as Burgundy and Riesling, show a difference in taste depending upon the agent used for fertilizing.

Hundreds of varieties of grapes are recognised by viticulturists, but those most in favour are enumerated here: For white wines, Sauvignon Vert, Golden Chasselas, and Bergher are used in America; Riesling, Ruländer, and white Burgundy are chosen in Germany. For the medium and light white wines of Germany, Elbling, Orleans, and Ortlicher are used. For the manufacture of red wines, Carbanet Sauvignon, the various Burgundy grapes, Laska, Trollinger, Mataro, Carignau, Zinfandel, Lenoir, and St. Lawrence grapes are the principal varieties. Pedro Ximenes, Black Burgundy, Trousseau, and Old Mission grapes are employed for the production of ports and sherries. Unless otherwise specified, grape wine will be referred to in this article when wine is mentioned.

Ripe grapes only are chosen for the production of wine. The expressed juice of the grape is received into vats and is known as *must*. At the ordinary summer temperature, or even at a temperature of 60° F., fermentation begins in the clear juice of the grape within half an hour. The juice becomes cloudy and thick and gives off bubbles of carbonic-acid gas which causes a froth to form at the surface containing the more solid parts. This is called the *head*. The grape-sugar formerly contained in the juice is now being converted into alcohol, and the fluid loses its sweet taste and becomes *vinous*. The fermentation is due, according to the best authorities, to the presence of *Saccharomyces apiculatus* and to the moulds adhering to the grape-skins. Within forty-eight hours after the beginning of the fermentation, *Saccharomyces ellipsoideus* takes the place of the ferment above mentioned, and the process is continued for an indefinite period, varying with the ripeness of the grape, its previous nourishment, its treatment, and the climate. The fermentation ceases after a varying time and is renewed by stirring the contents of the vat. When the fluid becomes perfectly clear it is considered wine and is placed in casks, where the fermentation is continued for from six to eight months. This continued fermentation is known as the secondary, in contrast to that which first occurs, the primary. It is essential for its perfection that air should be excluded, and it is sometimes necessary to add wine to it. The secondary fermentation may not be complete, and sometimes years after the wine is pressed from the grape fermentation occurs, a sign that it was not finished as it should have been when placed in the cask. During the entire time of fermentation

a frothy matter is formed which, with the colouring matters and tartar, eventually sinks to the bottom of the cask, when it is called *wine-lees*. The shortest time for wine to be ready to be bottled is two years. Wines very rich in sugar may undergo occasional fermentation for years, always with an increase of alcohol and a decrease in the acids, the tartar, and the sugar. It is during the secondary fermentation that the *bouquet* of a wine is developed, as the lees is formed: It consists of the odorous principles contained in the grape and those developed by the fermenting process. This is to be sharply distinguished from the *aroma* of the wine, which is recognisable by either taste or smell.

From one and a half to three per cent. of the wine usually evaporates annually through the pores of the containing casks, and in order to avoid the germination of mould and the consequent acetous fermentation, the cask must be refilled. The longer wine is allowed to remain sealed in casks, secure from the advent of air, the finer will its bouquet become and the greater its percentage of alcohol. Very old wine, however, is found to lose in alcohol. The preservation of wine is achieved by burning pure sulphur in the casks in which it is to be permanently stored. This process frees the vat from the possibility of becoming mouldy and is now almost universally practised. Filtering the wine or the adding of gelatin or albuminous substances to it is the means employed to make it clear. Red wines usually lose some of their colour by the employment of these procedures, and on these wines it is practised to a very small extent.

Among the agents used now and formerly for the preservation of wines may be mentioned salicylic acid, boric acid, electricity, plaster of Paris, peroxide of hydrogen, and phosphate of calcium. Plaster of Paris is commonly used in France and in most of the southern countries.

These various measures for preserving or improving wine have each a chemical basis, but the processes are so involved that they have not all been thoroughly worked out. *Salicylic acid* is employed to preserve wines by stopping the fermentative process. Its addition to food stuffs is prohibited in Germany, and König is of the opinion that the small quantity which can be added without giving the wine a disagreeable after-taste is ineffectual as a preventive of fermentation. *Boric acid* has been employed with the same intent, and, indeed, boric acid in minute quantities is found in the ash of the wine; but its effect upon the organism is by no means indifferent, and its employment is not to be recommended. Some Italian chemists have of late recommended *electricity* as a preservative of wines. The statement is made that the current aids in the improvement of the wine and helps to render it aseptic. But these results have not yet been confirmed. Experiments with *hydrogen peroxide* have also been made with a view to clearing the wine and ripening it quickly; but these, too, will require further elaboration to give the procedures a place among those regularly practised.

Of all the measures which have gained a wide prestige for the preservation of wines, the addition of *plaster of Paris* to the marc is the most constantly used. As mentioned above, it is freely practised in France, particularly in the southern portion, but it is generally employed in southern Italy, Sicily, Spain, and Portugal. Oxidized and non-oxidized plaster of Paris are both employed, and the statement is made that by this means fermentation is hastened, that the colour of the wine is improved, and that its permanence is increased. However, *plâtrage*, as the process is known to the French, is not only superfluous, but positively injurious, since it not only changes the wine chemically, but actually produces chemical bodies which may be injurious to the drinker. One of the dangers consists in the liberation of free phosphoric acid under certain circumstances. The chemical changes may be briefly stated as follows: When plaster of Paris is added to soluble salts of tartaric acid, an almost insoluble calcium tartrate and the bisulphate of potassium are formed. The sulphate of potassium may disintegrate some of the salts of phosphoric acid held in solution in the must, and free phosphoric acid result from this reaction. This is the German view. The French chemists think that through the influence of the calcium sulphate (plaster of Paris) the stability of the wine and its acidity are increased by the introduction into the wine of the potassium bitartrate which is in the grape, and, on account of its insolubility, usually remains in the lees. Chemists do not agree as to the changes that then take place. But it is safe to assume that tartaric acid, sulphuric acid, and potassa are set free in the wine, with the ultimate formation of potassium bitartrate and potassium bisulphate, the latter salt contributing to the increased acidity of the wine. The gravest danger lying in plastered wines is in the deleterious effects of the potassium sulphate upon digestion, upon the action of the heart, and upon the blood. It tends to reduce the alkalinity of the blood, as has been proved experimentally by Nencki, Lichtheim, and Lochsinger (*Journal für praktische Chemie*, new series, vol. xxv, 1882, p. 384). These observers gave a dog for eight days, with its usual food, from 30 to 45 grains of acid potassium sulphate, with the result of reducing the alkalinity of its blood 22 per cent. Concerning the plastering of wines they reach these conclusions: Wines which contain less than 15 grains of plaster of Paris to a quart have not proved injurious; when heavily plastered wines are used for a considerable length of time, the health may, however, become impaired; the sale of plastered wines should be a subject of legislative interference, and no wine which contains more than 15 grains of neutral potassium sulphate to the quart should be sold in the market. Considering the possible dangers to health, it seems rational to discard all wines which contain more than 5 grains of neutral potassium sulphate to the quart. The detection of the plastering of wines depends upon the demonstration of the presence of the acid potassium bisulphate or of the neutral potassium sulphate.

Attempts have been made to neutralize the calcium sulphate of the plaster of Paris by calcium phosphate, and it has been suggested that the potassium bisulphate may be neutralized by the addition of strontium tartrate and tartaric acid; but it has been found that these agents do not entirely remove the potassium salt, that equal quantities of strontium salts replace it, and that the wine is even more harmful than before. Various baryum salts—the nitrate, the chloride, the carbonate, the acetate, etc.—have also been recommended for the neutralization of the plaster of Paris, but, on account of their direct poisonous effects, are not employed. On the recommendation of Hugounenq, dicalcium phosphate may be employed for the preservation of wines and to promote their clearing. This process is called *phosphatage*, and is said to have all the virtues of the use of plaster of Paris without increasing the sulphuric acid or diminishing the phosphoric acid.

The following table shows the changes that take place in wines which have undergone *plâtrage* (Bersch, *Die Praxis der Weinbereitung*, 1889, p. 417), one half of a given quantity of wine having been plastered, the other half not:

	WINE.	
	Plastered.	Not plastered.
Specific gravity	0·9960	0·9955
Alcohol	10·99 vol. p. c.	11·80 vol. p. c.
Extractive matters	2·76 p. c. wgt.	2·50 p. c. wgt.
Total acidity	6·60 per cent.	6·00 per cent.
Volatile acids	0·71 "	0·69 "
Tartaric acid	1·50 "	1·50 "
Glycerin	8·20 "	8·20 "
Tannic acid and colouring matters	1·57 "	1·68 "
Sulphurous acids	1·52 "	0·33 "
Potassium sulphate ($HKSO_4$)	2·58 "	0·56 "
Ash	4·38 "	2·60 "
The ash contains:		
Sulphurous acid	35·0 "	15·0 "
Phosphoric acid	8·9 "	15·1 "
Ferric oxide and clay	0·9 "	1·8 "
Calcium	6·9 "	1·4 "
Magnesia	4·1 "	10·0 "
Potassium	43·8 "	57·0 "

To procure a diminished acidity of wine, calcium carbonate, calcium saccharate, or neutral potassium tartrate may be added. The wine takes up little or none of the calcium salt, and it is therefore scarcely injurious. Chaptal gave the name to the process by which sugar and calcium carbonate are added to must which is hyperacid. An increase in the quantity and sweetness of wine may be obtained by the process of Gall. After the better grapes are selected from the poorer ones, the poor ones are made into must, and to that is added at once an aqueous solution of grape sugar, so that the must shall contain a proportion of sugar, acids, and water equal to that of must made from the best of grapes. The good taste of poor wine is enhanced by this process, which is certainly not an honest one.

On the suggestion of Petiot, some inferior wines are made, especially in France, by fermenting the marc of the grapes, from which wine has already been prepared, with an aqueous solution of grape sugar. Some excellent wines may be manufactured in this way from grapes of superior quality; but the oftener the marc is placed in the solution of sugar, the poorer is the quality of the wine. As a rule, these wines have an agreeable taste. They are frequently adulterated with tannin, glycerin, tartaric acid, etc.

There are several other processes in vogue in wine-making countries for the improvement, adulteration, reduction of acidity, and increase of quantity of wines, but the main ones have been here mentioned, and the others are scarcely of sufficient importance to warrant their description in this article.

All wines have certain common properties. They are all spirituous liquors obtained by fermentation from fruit or grape juices, containing a certain quantity of alcohol, which varies with the juice and its subsequent treatment. Even wines of the same class differ materially in their amounts of alcohol. The following table shows the average percentages of alcohol in the principal foreign wines:

Port wine	19 to 23 per cent.
Sherry	15 to 25 "
Madeira	18 to 22 "
Bordeaux	9 to 15 "
Burgundy	7 to 13 "
Rhine wine	8 to 13 "
Moselle wine	8 to 11 "
Tokay	9 to 12 "
Champagne	5 to 15 "

(Johnston's *Chemie des täglichen Lebens*, Stuttgart, 1887, p. 267.)

The American wines contain from 10 to 25 per cent. of alcohol, according to their quality and variety.

All grape wines contain a certain proportion of grape-sugar, to which the sweetness of their taste is due and which is responsible for their fermentation. They all contain a varying quantity of acid which is responsible for the more or less conspicuous "vinosity" in the taste of the wine. The acids of wines are tartaric acid and acetic acid, the latter, as pointed out above, an impurity. Malic acid is found in wines which have been derived from unripe grapes; but it gradually disappears from the grape as it ripens, and its presence in unripe grapes is one of the reasons for choosing the ripe fruit of the vine for wine-producing purposes. The characteristic odour of wine is due to the presence of œnanthic ether, and it is possessed by all wines. This ether is a product of the fermentation of the must, and is said by Neubauer to contain as its principal elements caprylic and caprinic ethers. It is probably increased with the age of the wine, but is always present in very small comparative quantities, from 1 to 10,000 to 1 to 40,000 parts by volume. Aside from the general characteristic odour of wines derived from this source, each wine derives an aroma from the grape from which it is made which distinguishes it from all other wines.

The proverbial improvement attained by wines with age springs from the facts already enunciated. It may be well to repeat them briefly. As long as wine contains grape-sugar,

fermentation is induced which increases its percentage of alcohol. Wines that contain but little sugar do not improve much with age unless sugar-containing wine is added to them from time to time. The presence of œnanthic ether is fostered by the prolonged fermentation, and hence the wine gets a stronger odour. The acids of the wine are diminished by the separation of tartaric acid, which increases as time passes. Lastly, the clearness and the purity of the taste of the wine are increased by the removal of the ferment.

According to their colour, wines are divided into *red* and *white*. According to their taste, they are known as *spirituous*, *sweet*, *dry*, *light*, *sparkling*, *rough*, or *acidulous*. *Red wines* are made from the must of black grapes, fermented with the *marc*—i.e., their skins and seeds. *White wines* are derived from white grapes or from black grapes freed from the marc. The colouring matter of the skin of the grape is insoluble in water, but is dissolved by alcohol, and so the juice of grapes fermented with the marc becomes red as fermentation proceeds. A *spirituous* wine is produced from the juice of a grape that is very saccharine, in which fermentation is easily induced and proceeds until checked by the presence of a certain amount of alcohol. If the ferment is deficient in quantity and the sugar superabundant, a *sweet* wine will result. A *dry* wine is one free from excess of sugar. The grapes that contain but little saccharine material furnish wines having a comparatively smaller proportion of alcohol, which are known as *light* wines. *Sparkling* wines are those which continue to undergo fermentation in bottles with a production of carbonic-acid gas. The presence of tannic acid derived from the marc of the grape distinguishes the *rough* or *astringent* wines, while the *acidulous* wines are characterized by the presence of tartar or carbonic acid. Among the principal sweet wines are sherry, Madeira, port, champagne, muscat, and Tokay. The principal sparkling wines are champagne and Moselle. *Madeira* wine was formerly much in use. It is a white wine with a rich, aromatic flavour. Its frequent adulteration renders its quality uncertain. *Teneriffe* wine bears a close resemblance to Madeira, and when pure has a somewhat acid taste and a delightful aromatic odour. *Claret* is the most widely used French wine. It is a red, light wine. It is somewhat astringent and acid in taste, with a vinous flavour. The brands *Château-Lafitte*, *Château-Latour*, *Château-Haut-Brion*, and *St. Julien* are the most celebrated. Sherry wine, *vinum xericum* (U. S. Ph., 1870, Br. Ph.), and port, *vinum portense* (U. S. Ph., 1870), will be described under the official wines.

The classification of wines according to their source is convenient, and the principal ones will be here mentioned:

German Wines.—1. *Rhenish*. The best of these are the white wines. The wines made from Riesling grapes are particularly known for their delicate, delicious, refreshing flavour and their characteristic bouquet. They are sometimes of value in *nervous diseases*. The *Orleans* wines are stronger and lack the aroma of the Riesling products. The best known of these wines are Marcobrunner, Johannisberger, Rüdesheimer, Hochheimer, and Niersteiner. 2. *Main* wines, of which the *Steinwein* is the most celebrated. 3. *Pfälzer* wines. 4. *Moselle* wines. 5. *Aar* wines. 6. *Neckar* wines. 7. *Margrave* wines. 8. *Baden* wines. 9. *Bohemian* wines. 10. *Hungarian* wines: white—Œdenberger; red—Ofener, Tokay, Erlauer.

French Wines.—1. *Champagnes* may be either red or white. The white champagnes of France are famous and are consumed in all parts of the world. 2. The *Burgundy* wines are noted for their agreeable and delicate flavour and for their stimulating properties. The most famous white varieties are Chablis and Pouilly, while the best-known red Burgundies are Chambertin, St.-Georges, Pommard, and Blanue. 3. The *Bordeaux* wines are known for their agreeable, peculiar perfume and their slight astringency. The red varieties are the clarets above mentioned. The best-known white ones are Rions, Sauberne, and Barsac.

Of Spanish wines, Malaga, sherry, and Alicante are widely known for their "body." The type of the white wines of Portugal is Bucellas; of the red, port.

Many of the Italian wines are known: Albano, Alliatico, Marsala, Orvietto. The African wines, Madeira and Teneriffe, are described above.

American wines have of recent years attracted attention for their increasing purity and strength. The first attempts to grow wines in this country failed early in the century, but the value of the Schuylkill muscatel grape and of the North Carolina Catawba grape was proved, and these varieties were subsequently employed in the manufacture of wine. It is only within very recent years, however, that the quality of American wine has attracted the attention of home consumers. Wines of great diversity of flavour, acidity, and alcoholic strength are now manufactured in America. Although most of them contain alcohol and sugar which have been added for preservation or improvement, American wines can be secured, as a rule, free from harmful adulteration and in a condition of assured purity. Among the *dry red wines* made in this country are Concord, Clinton, Cynthiana, Sonoma, Red Mission, Zinfandel, and California claret. Well-known *dry white wines* are California muscatel, California Sonoma hock, Pleasant Valley, Catawba, Sonoma Riesling, and white Concord. *Sweet* wines are made in many parts of the United States. *Port* wines, *sherry* wines, and *sweet Catawbas* appear in the market in several varieties. Many American *champagnes* have attracted notice of late years and will undoubtedly supersede the foreign product in time. Prominent among these wines are "grand prize," medium dry; "eclipse," extra dry; "gold seal," and Cook's imperial.

Vines for the product of their grapes are grown in California, in Texas, in western New York, and in southern Ohio. California leads, her output in 1893 being 20,000,000 gallons of wine. While this can not be compared in point of quantity to the product of some of the wine-making countries of Europe, the production will no doubt be increased as the merits

of American wines become better known and the demand for them is augmented.

Besides the juice of the grape, there are juices of several other fruits that undergo vinous fermentation. *Cider* is the fermented juice of the apple. It is consumed in large quantities in southern Germany, France, England, and the United States. The expressed juice of the apple soon undergoes fermentation without the addition of a ferment agent. It contains a large percentage of grape-sugar, which becomes converted into alcohol in the manner above described. The taste and the quality of cider depend upon the variety and ripeness of the apples from which it is made, the climate, the soil, and the care of the trees. Cider is not permanent and easily undergoes acetous fermentation. *Perry* is the fermented juice of the pear and resembles cider in its properties.

The juice of all varieties of palms is rich in grape-sugar, and is therefore easily fermentable. *Palm* wine is made and drank in the islands of the Indian Archipelago, in Sumatra, in India, and in the Philippine Islands. The best palm wine is said to be found on the western coast of Africa. In the oasis of Tosar, the residents of which are Mohammedans, palm wine is a customary drink and is known as "lagmi." The drinkers justify themselves, it is reported, by saying: "Lagmi is not a wine; the edict of the prophet is against the use of wine only." The wine of the palm is produced in Chile and in most tropical countries. In Africa it is the only native alcoholic drink. In Asia it is consumed in enormous quantities.

A wine may be derived from the *sugar cane* by spontaneous fermentation. No chemical analysis has ever been made of it, although it is highly prized by the negroes of the Southern United States. *Pulque*, *octli*, or the wine of agave, is a favourite drink, intoxicating in character, of the lower classes of Mexico. It is obtained by the fermentation of the juice of the maguey, or *Agave americana*. The juice has a sweetish taste and soon acquires a disagreeable odour. It undergoes spontaneous fermentation, and when mixed with other juice from the same species which has already begun to ferment, it ferments very rapidly. In twenty-four hours the pulque has its pleasantest taste and effects. It acquires the peculiar odour of putrefying or gamy meat, and is therefore not easily partaken of by those not accustomed to drink it. It is very refreshing and cooling in its effects, but even a small quantity may be sufficient to produce intoxication. The Mexicans maintain that pulque possesses many therapeutic properties of value: It aids digestion, promotes sleep, and is helpful in many gastric diseases.

The juice of the *birch* provides a sweet, agreeable, sparkling wine. The wine of *honey*, or *mead*, was formerly popular in Germany, and is said to be drank at the present day in Russia. The best known of the berry wines are *currant*, *gooseberry*, *strawberry*, *blackberry*, and *raspberry* wines. They are all agreeable drinks and are commonly drank diluted as refrigerants in summer. Blackberry wine or brandy has some reputation as a remedy in *diarrhœa*. The famous wine of the Tartars, *kumyss*, or *koumyss*, is the fermented milk of the ass. It is now prepared in most civilized countries by the artificial fermentation of cow's milk, and possesses some nutritious properties. It is easily digested and assimilated, and is frequently employed as a substitute for milk in conditions in which the stomach can not digest the raw product. For such usage it is a valuable adjuvant in the treatment of *asthenic conditions* and as a food in the *vomiting following anæsthesia*. (See KUMYSS.) The *leban* of the Arabs and the *yaurt* of the Turks are wines similar to kumyss. In some parts of Ireland and Scotland and in the Orkney Islands *buttermilk* is sometimes kept until fermentation has set in. It then acquires intoxicating properties. The juice of the *orange* is sometimes allowed to ferment, giving rise to a typical wine.

An infusion of malt is capable of undergoing fermentation, giving rise to the *malt liquors—ale*, *brown stout*, *porter*, and *lager beer*. They are practically wines, but their consideration does not properly come under this heading.

Champagne was first made in the latter half of the seventeenth century by Pérignon, a priest in the convent of St. Peter at Haut-Villers, although the crude article had been known and prized for centuries. Its manufacture rapidly spread, and to-day good qualities of champagne are made in the United States, France, Germany, Austria, and Italy. In this country French champagne is the favourite, although the American brands are making their way to the front. Blue grapes make the best champagne, and those containing a minimum quantity of colouring matter are usually chosen. Burgundy, Ruländer, and Riesling are used for fine champagnes. For the inferior qualities Ortlieber, Steinschiller, and Gutedel are frequently employed.

The preparation of champagne has been brought to a state of perfection in France. The selected grapes are rapidly pressed and the must obtained is allowed to undergo complete fermentation in order that all traces of sugar may be removed. After this wine has cleared itself it is mixed with other wines of chosen type and character (*coupage*). This mixed wine, which is the basis of the champagne, is repeatedly cleared and drawn off, and in the spring of the year, as a rule, has added to it from 1 to 2 per cent. of sugar for the production of the carbonic-acid gas. This is accomplished by adding a liqueur which contains ordinary candy sugar, wine, and cognac in the proportions of 150, 125, and 10. This is used for the better champagnes; beet-sugar is employed for the cheaper ones. Sometimes port, Madeira, muscatel, or cherry-water is added to the liqueur if it is desired to produce a particular flavour. The amount of liqueur added depends upon the pressure it is intended to secure and the absorptive ability of the specific wine. French champagne producers distinguish three kinds of carbonated wines: *Crémant*, which has a carbonic-acid gas pressure of about four atmospheres; *mousseux*, with a

pressure of from four to four and a half atmospheres; and *grand mousseux*, with a pressure as high as six atmospheres. The familiar form of champagne bottle is employed because it enables the gas to remain at the original pressure.

The bottles are now carefully corked, leaving a space at the top of from twelve to fifteen cubic centimetres. They are placed horizontally in the fermentation cellar, which has a temperature of from 68° to 75° F. As the fermentation proceeds, the position of the bottle is gradually changed every few days until at the end of about two weeks it stands vertically, cork downward. During this process a precipitate has been formed which falls against the cork. As soon as the workmen are certain that precipitation is complete, *dégorgement* is practised. This consists in removing the cork, when the precipitate, together with a small quantity of the wine, is hurled from the bottle by the force of the pressure behind it. The bottle is again filled to its former degree by *dosage* with a liqueur which varies for different champagnes. It can be made sweet or dry, mild or strong, according to desire. The bottle is then so handled as to avoid the loss of any more carbonic-acid gas than is necessary, it is corked, the cork is secured with cord and wire, and all this is covered as far down as the empty space extends with tin-foil or sealing-wax. The other methods of making champagne are inferior, but it is of historic interest to note that the older method consisted in forcing carbonic-acid gas into bottles containing wine already "dosed" by means of a force-pump.

A champagne must naturally, to be pure, have the basis of an aerated water, as outlined above. Chemically, it must contain no impurities injurious to health. Saccharin, oxalic acid, and salicylic acid are used in France to some extent as adulterating agents, and should be tested for if their presence is suspected. After champagne has been poured out into glasses, evidence that it is not an artificially aerated water may be adduced by stirring it. If it foams as it did when first poured out it is a pure or at least a natural champagne. If not, it is to be condemned as artificial.

The medicinal uses of champagne are those of a *stimulant*. It may be given in *convalescence* from any adynamic disease, and is serviceable when a patient is suffering from the effects of severe *shock* or *collapse* and when he is able to take fluids by mouth. It is of real value in cases of *vomiting* due to almost any cause. At these times, when the stomach refuses to retain anything else, cold dry champagne in small doses will usually be retained and may frequently stop the vomiting altogether. It is of special use in the vomiting following anæsthesia when this is prolonged beyond the usual time. In cases of *anæmia* and *chlorosis*, when iron is not well borne by the stomach, it may sometimes be found useful to give it with small doses of a dry champagne. It is a good stimulant after fatigue or overexertion, but a too long-continued use of this wine is apt to produce cirrhosis.

The effects of champagne are those of other diffusible stimulants, but that it does excite especially the intellectual centres, producing an unusual flow of wit and humour, its popularity at dinners and among postprandial speakers testifies. When drank as other fluids are, two or three glasses of champagne will rarely intoxicate one accustomed to any alcoholic drink, but when slowly sipped it may give rise to the symptoms of acute alcohol poisoning after half a glass has been taken.

Although the *effect* of wines is dependent, to some extent, on the alcohol they contain, the liquid is so complex that much of its influence upon the human body must be ascribed to the salts, ethereal bodies, sugars, and acids in which it abounds. The action of wine is mainly *stimulant*, and this effect is derived mainly, it is true, from its alcohol. It is probably, however, not correct to state that an equal quantity of water containing the same percentage of alcohol will accomplish the same result. After drinking wine, the whole organism responds to it. The activity of the nervous system is quickened, the special senses become more susceptible to impressions, and the intellectual faculties are more active and alert. The pulse becomes more rapid, and the cheeks usually become flushed and the eyes bright. It depends, of course, upon the variety of wine taken, whether these effects are more or less pronounced. The sparkling wines produce them rapidly to a high degree, stimulating the mental faculties particularly. The still wines have a less marked stimulant effect. On the other hand, the sparkling wines have a tendency to derange gastric digestion; the still wines have little influence in this direction.

In a physiological study of the influence of alcoholic drinks upon the chemical processes of digestion, R. H. Chittenden and L. B. Mendel (*American Journal of the Medical Sciences*, April, 1896) conclude that wines in small amount have little or no deleterious action upon the chemical processes of gastric digestion. In small amount they may even increase the rate of digestive action. In larger quantities they have more or less of a retarding effect, which is dependent more upon the character and amount of the solid matter present than upon the alcohol. On pancreatic digestion, however, they find that wines have a greater inhibitory action than the stronger alcoholic liquors. This action seems to be entirely independent of the amount of alcohol, but is closely connected with the acidity of the fluid. On salivary digestion, wines as a class show a very powerful inhibitory action, due almost entirely to their acid properties; for when the acidity of a wine was experimentally neutralized, it lost completely its inhibitory effect upon salivary digestion.

An exaggeration of these physiological effects of wine is found in the condition of acute alcohol poisoning, commonly called drunkenness or intoxication. A condition approaching delirium appears after the ingestion of more wine than can be tolerated by the system. Depending upon the temperament of the individual, he may be joyful or morose, combative or

peaceful, erotic, benumbed, or active. These symptoms gradually subside, the speech becomes incoherent and thick, the head whirls, and vision and perception of space and objects become blunted. It is a curious fact, frequently observed and commented upon, that those faculties most constantly employed are the last to succumb to intoxication. An educated person will continue to reason long after he has lost the support of his limbs, while a labourer, though unable to talk, finds himself able to carry on his work. An intoxication ends in two ways: Either there is gastric derangement, with vomiting, diarrhœa, and sometimes evacuation of the bladder, or a condition of somnolence supervenes, characterized by an alcoholic breath, a flushed face, dilated pupils, a slow, full pulse, stertorous breathing, and sweating. Recovery is the rule, although a fatal result has often been known.

The habitual dietetic use of wines is possibly harmless, but it is certainly useless in health. Yet it is an established fact that, in the wine-drinking countries of Europe, one sees little of the bad effects of the constant use of the beverage; and in France and Germany it is used by persons of all ages and of both sexes. It is said that gout and calculous disease are scarcely known along the Rhine. The light wines of Germany and France, diluted, may be drank with safety for many years. But the heavier wines, such as sherry, port, and Madeira, are apt, after prolonged use, to induce diseases of the liver (cirrhosis), gout, apoplexy, and those conditions which are due to overstimulation. The light wines are refreshing after exertion, and exert a protective influence when the organism is subjected to a severe tax. In one of the hospitals of New York an old custom prevails of giving claret, well diluted, to all those resident in the building during an epidemic of cholera, typhus, or small-pox. It is possible that wine produces a deleterious effect upon the complexion, and that it may prematurely arouse adult passions in children who drink it frequently. The habitual use of saccharine wines must be forbidden to persons who have gout or a tendency to obesity or to the gouty diathesis.

In an investigation as to the medical properties of the Bordeaux and Burgundy wines, the *Lancet* commission decided that the white Bordeaux wines excited the appetite, were a direct aid to gastric digestion, and were slightly aperient. The sauternes, it was found, were at first stimulating and later had a sedative effect. This action was more pronounced upon nervous and easily excitable persons. The white Burgundy wines had not, as had been believed, a constipating influence, but the reverse. The clarets were found to have neither a stimulant nor a sedative influence, which the commission attributed to the combination of tannin with a small percentage of alcohol. Taken with the meals, claret was found to have an influence beneficial to digestion. The red Burgundy wines are not so helpful to digestion as claret, and seem to show a tendency to cause obesity. These wines are not well suited to the gouty, and diabetics can not take them, because of the sugar they contain. (*Lancet*, June 26, July 3, July 24, October 23, 1880.)

As to the sustaining qualities of wine, there can be little difference of opinion. Druitt (*Medical Times and Gazette*, 1878, vol. ii, p. 364) prints his correspondence with a French army surgeon and a French lady who were in Paris during the siege. Both of them give high testimony to the worth of *vin ordinaire*, at a time when it was impossible to obtain other nourishment, in sustaining the vital powers. The surgeon gives evidence as to how his soldiers withstood severe injuries with no other food than the wine given them. This question is discussed fully in the article Alcohol.

In the treatment of disease, wine is used differently from the more ardent spirits. In an acute anæmia, for example, dependent upon a severe hæmorrhage, alcohol in a more rapidly assimilable form is called for, such as whisky or brandy; but if the patient recovers, wine would be indicated as a tonic to help him over his debility. In cases in which the prolonged use of an alcoholic stimulant is demanded and when the disease is of a mild grade, or when the stomach can not tolerate whisky or brandy, wine is pre-eminently the agent to use. This is not the place, and the writer has not the wish, to discuss the mooted question as to the wisdom of employing wine in disease. He assumes that the intelligent employment of some alcoholic stimulant is to be taken for granted.

When wine is used medicinally it is essential that a genuine wine and a good wine be employed. Adulterated wines will prove injurious only, deranging the digestion and impairing the appetite, if not inflicting more serious injury. In general, it may be said that sherry, containing little acid, is indicated when the stomach is weak and there is acid dyscrasia. Port is to be preferred in cases of *pure debility*. Claret is useful as an aperient and diuretic. Champagne is given in the *debility of old age* and in the *collapse of low fevers*. Acidulous wines are not to be given to gouty subjects, nor sweet wines to diabetics.

Young infants may receive marked benefit from the judicious administration of port wine, given at hours other than meal times, when suffering from *marasmus* from any cause, *catarrhal affections* of long standing, *tuberculosis*, or *rhachitis*. The appetite and nutrition are improved materially. Sherry promotes *sleep* and aids *digestion* in *senile debility*, depending for its effects not only upon the alcohol, but upon the ethers developed in it. In *fevers* of all kinds, those of the *acute infectious diseases* as well as in those coming from *acute inflammatory processes*, wine fortifies the system and helps it to get rid of the deleterious materials circulating in the blood. It is particularly valuable when there is high delirium or great nervous prostration, with a rapid dicrotic pulse which has a tendency to become arrhythmical. In *typhoid fever* and in *typhus fever* when there is absence of the impulse and first sound of the heart, port wine is a valuable agent, administered in large doses. In the *pneumonia* and *bronchitis of the aged* it is a helpful remedy as

well. In the exhaustion of fevers, marked by *insomnia* and *feebleness of the heart*, as seen in the third and fourth weeks of *typhoid fever*, port wine is good. The use of wine is indicated, too, when derangements of digestion and nervous prostration appear, entirely out of proportion to the gravity of the disease. For these purposes, from six to twelve ounces may be given daily in divided doses at half-hourly intervals.

In threatening *cardiac failure* in the acute delirium of some form of insanity, wine is a useful remedy. It has been recommended in catarrhal inflammations accompanying *epidemic influenza*, in the *intestinal catarrhs* of summer and autumn, and as a stimulant in *amygdalitis*. In *purulent inflammations* of long standing and in *chronic discharges of blood, pus, or mucus from the uterus, vagina, urethra, intestines*, or *lungs*, or from *fistulæ* or *ulcers*, claret wines are highly recommended. According to Binz, the alcohol tends to check the emigration of leucocytes and, on the authority of Anstie, it helps to overcome the excessive metabolism of the tissues. In addition to this, it is no mean stimulant and supporting agent to one whose vitality has been drained by a long-continued discharge of pus.

After recovery from a *hæmorrhage*, strong wines may be given for their tonic effect upon the heart and peripheral blood-vessels. Half an ounce, from five to six times daily, is the proper dose. In the *acute neuroses*, such as *infantile convulsions* and *acute chorea*, the patients are very tolerant of wines, and the affections are sometimes decidedly relieved by them. In *acute neuralgia* the ethereal wines occasionally give great relief from pain. Champagne is an excellent agent, given cold in small, often-repeated, doses, with which to control the *vomiting following anæsthesia* and the *vomiting* of *seasickness* and *pregnancy*. In *general debility* which has its origin in anorexia or dyspepsia a Burgundy or a red Hungarian wine is of good service. Anæmic and chlorotic patients do not require wine; but a *progressive chlorosis* may be benefited by its use.

The use of wine in *pulmonary tuberculosis* has been fought by physicians for years. It is probably correct to state that, when the wine chosen for the purpose, which must be carefully considered in every case, reduces the fever and the night-sweats and strengthens the pulse, it is an eminently fit agent. Anything which will favour the fortification of the patient's strength is a legitimate remedy in this disease, and wine frequently does.

Wines—pure wines—have been recommended in debility arising from *protracted pain* or *scurvy*, and in the chronic affections of the *scalp* and *eyes* of poorly nourished children. It has been advised to give it by enema in cases of *gastralgia* in which the stomach can not tolerate preparations of iron. *Tetanus* is said to have been cured by wine, and its injection has been recommended in *chronic discharges from the vagina* and *urethra* and to lessen the discharge from *fistulæ*. Claret has also been used as an injecting fluid into the tunica vaginalis for the cure of *hydrocele*. The white wines of Bordeaux have been praised as *tonics* where there is a *capricious appetite* and for the decrease of *corpulency*, and they have been found useful in cases of *biliary indigestion*. Sauterne wines are praised for their tonic influence in pulmonary cases when there are *insomnia* and *troublesome cough*. The white Burgundy wines have been found of service in *convalescence* from any prolonged disease. Clarets are widely used as *tonics* to be taken with the meals; they rarely upset the stomach, and are agreeable to the majority of debilitated patients. In *anæmia* and *debility* from any cause and in *atonic gout* they are useful. Diluted, they are excellent refrigerants in the course of a febrile disease. In *malnutrition* not dependent on gastric or intestinal irritation, and as a *tonic* for convalescents, the red Burgundy wines are widely employed. Since they are ultimately sedative in their action, their use may preclude the administration of any narcotic agent.

The quantity of wine to be administered must vary, of course, with the disease and the patient. In low fevers sometimes a pint, frequently a quart, may be given in twenty-four hours. It may be administered pure, diluted with water or mineral waters, or in the form of *wine whey*. This is made by adding to a pint of boiling milk half a pint of some white wine, straining through a cloth, and adding loaf-sugar to the filtered product.

The adulteration of wines is frequently practised oftener in this country and France than in other European countries. Although at the present day these adulterations are not directly poisonous, they usually provoke disturbances of the stomach, and are reprehensible for this reason not only, but because the products are sold as genuine wines. The most frequently adulterated wines are port and Maderia, although claret, too, is frequently imitated. *Lead* is frequently found in minute quantities. This may spring from the shot with which the bottles are cleansed or from some analogous source. In the early part of this century English wine-dealers were in the habit of putting large quantities of shot into the barrels containing wine to keep it from turning sour. The use of oxalic acid was suggested if the lead did not answer the purpose. (Citation from *The Wine Dealer's Manual, British and Foreign Medical and Chirurgical Review*, April, 1858.) *Cider* or *perry*, diluted with water, may be palmed off as genuine wine. Frequently inferior wines may be made more easily salable by the addition of a small quantity of a higher grade of wine. Alcohol is added to thin wines, sour wines are sweetened with sugar, honey, or raisins, and pale ones are coloured with burnt sugar. Acetate of lead may be added to wines to give them astringency, and acidulous wines are sometimes neutralized by the addition of lime or alkalies. Red wines are often made out of alcoholic dilutions, the colouring matter being beets, litmus, rhatany, or logwood, and astringency is given to them by the addition of alum, tannin, or oak or willow bark. Colouring matter is employed by many wine-dealers, usually made of alum and elder berries.

Free sulphuric acid can not be detected by barium, since all wines contain some soluble sulphates. If a few drops of the suspected wine, however, are dropped on a piece of glazed paper containing starch, the texture of the paper will be unaltered and the spot, when dry, will be violet if the wine is pure; but if it contains only a trace of sulphuric acid, the spot will be rose-red and the paper will be friable. Adulteration has been known from Pliny's time, and this historian inveighs bitterly against the decadence of the times since "no one can get pure wine to drink." It is known at the present day in Germany, more in France, and less in England, but most of all it is found in the United States.

Wines are subject to a number of disorders, which will be briefly considered here. One of the commonest of these is the *viscosity* of wine, by which it becomes slimy, thick, and threadlike. It appears more frequently in wines poor in tannic acid, and is therefore more commonly found in white than in red wines. In acidulous wines this disorder sometimes disappears spontaneously, particularly if they contain a considerable percentage of alcohol. It may be cured by shaking the wine and allowing the entrance of air, or by adding grape-sugar to induce a new fermentation.

Acetous fermentation may take place in wines through the growth of the fungus *Mycoderma aceti*. It is the most dangerous of all the disorders of wines, since it may make the wine unfit to drink in a very short time. This fermentation occurs chiefly in old wines with a small percentage of albuminous matter, in warm cellars, and when the barrel is not kept full. When a wine has become decidedly tainted with acetic acid, it is best to allow it to be converted entirely into vinegar. Pasteurization (*vid. infra*), electrolysis, and the pouring of the wine into another cask impregnated with sulphur have been suggested as cures.

Lactic-acid fermentation may be caused in wines by chain-forming bacteria which are even noticeable to the naked eye as masses. The wine attains a smell and a taste which render it unfit for drinking. Other bacteria affect wines differently. It may become *putrid*, developing carbonic-acid gas and becoming turbid. The colouring matter of white as well as of red wines changes to brown, and a disagreeable odour and taste are developed. This change occurs chiefly in wines poor in alcohol which have been made from poor or rotten grapes.

Through the action of a ferment not yet described, wines may become *bitter*. This is a peculiarity of red wines, and was first noted by Pasteur. It may take place through the action of ammonia and air on an aldehyde which sometimes develops in the wine. There is a decided lessening of the colour and of the tannic acid in this disease, and the wine is not palatable. Wines may become *mouldy*. This occurs only in wines deficient in alcohol, and is accomplished by the growth of a mould on the surface of the urine.

Red wines may *lose their colour* from a variety of causes. It is normal for all red wines to become somewhat lighter in colour as their age advances. But the wine may acquire a pallor, which is usually due to the cleaning of the containing casks with lime or with water impregnated with lime and the presence of too much air during the primary fermentation. To preserve its colour, it may be mixed with a proportionate quantity of darker wine. By chemical action, red wines may become *black* and white wines *green*, *gray*, or *brown*. This condition is usually cured spontaneously if the wine is allowed to lie for a period.

Among the other disorders to which wines are subject may be mentioned the *smell of sulphur*, which is usually attributable to the earth in which the grape has grown or to some external influence; a *mouldy taste*, acquired by the wine if it is preserved in mouldy vats; and the taste of the barrel in which it is kept. The same holds true of the wood from which the casks are made. The oak, larch, and mulberry barrels, for instance, give the wine a peculiar taste. The taste acquired by the wine from the ground in which the grape was grown, which is usually very characteristic, may be diminished by repeated withdrawal of quantities of the wine and refilling the cask with fresh wine (*Die menschliche Nahungs- und Genussmittel*, von Dr. J. König, Berlin, 1893; *Handbuch der chemischen Technologie*, von Dr. F. Fischer, Leipsic, 1893).

Pasteur suggested a method of ridding wines of most of the disorders to which they are subject by warming them to a temperature of 140° F. This process is technically known as "Pasteurization," and may be easily accomplished by the apparatus of Ballo (Fischer, *op. cit.*).

As a rule, wines clear themselves; but to augment or hasten the process, sweet wines may be rendered clear by clay or albuminous bodies, which gradually cause the insoluble substances to sink and to be thus easily removed. The colour of red wines is said to be heightened by the addition of plaster of Paris to the must.

Vinum album (U. S. Ph.), white wine, is "made by fermenting the juice of fresh grapes, the fruit of *Vitis vinifera*, freed from seeds, stems, and skins." When a white wine is prescribed without further specification, a domestic dry white wine is recommended; such are California Riesling and Ohio Catawba. Port wine and sherry wine were formerly official in the U. S. Ph., but the increasing excellence of domestic wines induced the committee of revision in 1880 to return to the old nomenclature of white and red wines, and to allow any white or red wine to be used which was of the required purity and alcoholic strength. Any German or other white wine is called *vinum album* (Ger. Ph.).

Vinum album fortius (U. S. Ph.), stronger white wine, is a mixture of white wine with one seventh as much of alcohol of a specific gravity of 0·820. It must contain from 20 to 25 per cent. by weight of absolute alcohol.

Vinum rubrum (U. S. Ph.), red wine, is "made by fermenting the juice of fresh coloured grapes, the fruit of *Vitis vinifera*, in

presence of their skins." The pharmacopœia recommends, when no specification is made, the use of a domestic dry red wine, or a native claret or Burgundy; any German or other red wine is allowed by the Ger. Ph. (For the pharmacopœial requirements of vinum album and rubrum, see the dispensatories and pharmacopœias.)

Vina medicata, medicated wines, possess the advantage, because of their alcohol and acid, of rendering some drugs soluble which do not easily dissolve in water. They are not stable, and few are at present in use. The purest wines should always be chosen when they are prescribed.—SAMUEL M. BRICKNER.

WINTERGREEN.—See GAULTHERIA.

WITCH-HAZEL.—See HAMAMELIS.

WITHERITE.—See *Barium carbonate*, under BARIUM.

WOOL-FAT.—See LANOLIN.

WORMWOOD.—See ABSINTHIUM.

WRIGHTIA.—*Wrightia* (or *Holarrhena*) *antidysenterica*, an East Indian apocynaceous tree, has a bitter bark which was formerly an article of European commerce under the names of *conessi bark* and *Tellicherry bark*. It was used in *diarrhœa* and *dysentery*. It contains a poisonous alkaloid, *wrightine*, which is supposed to be the active principle, but has not yet been sufficiently studied to warrant a recommendation of its use in medicine.

XANTHOXYLUM (U. S. Ph.) is the bark of *Xanthoxylum americanum* and of *Xanthoxylum Clava Herculis*. Its common name is prickly ash. The former species grows in the Northern, Middle, and Western United States, in rocky forests. It is a shrub from five to ten feet in height, and its alternate branches are covered with strong prickles, whence its popular name. The shrub is a polygamous plant, flowering in April and May before the appearance of the foliage. The leaves and capsules possess a lemon-like odour. *Xanthoxylum Clava Herculis* is indigenous to the territory extending from the Atlantic coast to western Texas and from Virginia to the Gulf of Mexico. It varies in size from a large shrub to a small tree. Its bark and branches are also covered with sharp, warty prickles. Both varieties belong to the natural order *Rutaceæ*.

In addition to the official shrubs recognised, there are several other varieties of the plant which are used medicinally in the localities in which they grow. In the Argentine Republic *Xanthoxylum naranjillo* is employed as a *diuretic* and *sudorific*. The Brazilians make a decoction of *Xanthoxylum singuassiba* which is alleged to have powerful sudorific properties and is widely used as a gargle in *inflammatory* and *non-inflammatory affections of the throat*. A tincture is used locally for severe *toothache*, with a reported *analgetic* influence. In the bark of this tree an alkaloid similar in its properties to pilocarpine has been found.

Under the name of *yellow Hercules's club* and *yellow thorn*, the bark of *Xanthoxylum caribæum* has made its appearance in commerce. This is the *satin-wood* of southern Florida and the West Indies. Its bark is thin, with a bitter, disagreeable taste, and has a canary-yellow colour which is imparted to the saliva when the bark is chewed. An alkaloid derived from this bark, when hypodermically injected into frogs, rabbits, or guinea-pigs, produces paralysis and subsequent death. In India *Xanthoxylum alatum* is used as an *anthelminthic* and *sudorific*. The *Xanthoxylum nitidum* of China is said to possess *febrifuge* properties. On the west coast of Africa *Xanthoxylum senegalense* has its habitat. Several alkaloids have been isolated from its bark, artarine the principal one, and one that resembles cubebine in its effects. The drug artar root is said to be derived from this shrub.

In 1829 Staples isolated from *Xanthoxylum americanum* a crystalline principle which he called *xanthoxylin*. The same result was obtained fifty years later by Lloyd. Moffet, in a subsequent analysis, obtained an alkaloid of yellow crystals which were soluble in alcohol and in chloroform, insoluble in ether and in benzene. Colton, who examined *Xanthoxylum Clava Herculis*, isolated crystals which formed colourless, tasteless, silky needles, soluble in alcohol, in ether, and in chloroform, insoluble in water (*American Journal of Pharmacy*, 1880, p. 191). An alkaloid resembling *berberine* has been found in *Xanthoxylum Clava Herculis*. The bark of *Xanthoxylum americanum* occurs in curved or quilled fragments. The bark of *Xanthoxylum Clava Herculis* resembles it but is thicker, and is marked by many conical, corky projections and by stout, brown spines rising from a corky base (Bridges, *Proceedings of the American Pharmaceutical Association*, 1864). The bark is brittle, very light, and almost without odour. The taste is at first sweetish, then bitterish, and finally acrid.

Xanthoxylum is said to resemble guaiac in its remedial action. It evokes a sense of heat in the stomach when ingested, increases the force and frequency of the pulse, and produces to some extent diaphoresis. Upon the nervous system it is stimulant as well. On account of its acridity, it has been employed locally as a *sialagogue*. An infusion, used on compresses, is said to have a revulsive action which is taken advantage of in *chronic constitutional syphilis*. It has some reputation as an *emmenagogue* and *galactagogue*. Success has been alleged for it in the treatment of *chronic rheumatism*. For *diaphoretic* purposes, for expelling *flatus*, and for the allaying of *rheumatic pains*, xanthoxylum has been employed. As a counter-irritant, it may be employed in *inflammations affecting the serous membranes*. In this way it has been used in *chronic pelvic disease of women* in the form of a hot pack. As a means of relief from *toothache*, the bark is sometimes chewed.

The fluid extract, *extractum xanthoxyli fluidum* (U. S. Ph.), may be given in doses of from ½ to 1 fl. drachm. A decoction may be

made by boiling 1 oz. of xanthoxylum in 3 pints of water. A pint may be given, in divided doses, in twenty-four hours. A saturated tincture may be administered in doses of 10 drops three or four times daily. A powder is prepared from the bark, the dose of which is from 10 grains to ½ a drachm three or four times daily.—SAMUEL M. BRICKNER.

XEROFORM.—Dr. E. Heuss, of Zurich (*Therapeutische Wochenschrift*, April 19, 1896; *New York Medical Journal*, May 9, 1896), remarks that xeroform, or bismuth tribromphenol, $C_6H_2.Br_3O$-Bi-O, was recognised as an efficient *intestinal antiseptic* in the last cholera epidemic in Hamburg, but was not then recognised as a *surgical antiseptic*. He describes it as an exceedingly fine yellow, neutral, insoluble powder, stable in the light, having a faint odour of carbolic acid, almost non-poisonous, and unirritating to mucous surfaces. It has but little effect on the human organism, but it is so highly poisonous to the comma bacillus that Hueppe declared it almost a specific against the cholera micro-organism. The author's experiments, published in the *Therapeutische Monatshefte*, show that it is an excellent surgical antiseptic. He first used it with very good results in the treatment of *chancroids;* if they were not complicated with buboes, they healed in from eight to fourteen days. In various *suppurative* and *necrotic affections*, such as *foul ulcers*, *buboes*, *infected wounds*, *paronychia*, etc., after a preliminary cauterization with pure carbolic acid, it promoted the cessation of suppuration and led to prompt granulation and cicatrization, and never gave rise to any surrounding inflammation. In *burns*, xeroform, like iodoform, seemed to exert an *anodyne* action. In such skin diseases as *eczema impetiginodes* and *eczema madidans* a 10-per-cent. paste of xeroform promptly checked the discharge, and cicatrization speedily ensued. It seemed to have a favourable effect in a few cases of *localized itching*, and a number of *tuberculous ulcers* and *glands* healed quickly under a xeroform dressing applied after curetting.

Xeroform seems to be itself inert, but on its coming in contact with an alkaline liquid, such as the tissue juices, the tribromphenol is gradually set free and exerts its action on the bacteria, while the bismuth oxide tends to check fermentation and acts as a desiccant. Xeroform is inferior to iodoform as a promoter of granulation. Its antiseptic power seems to be somewhat impaired by mixing it with fatty substances; hence it is better to use paste or a gauze impregnated with it. Its cost is about the same as that of iodoform, but it is cheaper to use it, because only about half the amount is required that would have to be employed of iodoform.

It may be given internally in doses of from 7 to 15 grains, three times a day, in *intestinal catarrh*, including the *summer diarrhœa of children*, also in *chronic urticaria* and in certain forms of *eczema in children*.

X RAYS.—The X rays, or *Röntgen rays*, are chiefly of interest to the medical profession from the point of view of diagnosis, but they have been employed therapeutically also. Our knowledge of them has been so recently acquired that some account of their nature and the processes of making use of them is appropriate. The following, therefore, is condensed from a paper read before the Medical Society of Victoria in August, 1896, by Dr. F. J. Clendinnen, of Melbourne (*Intercolonial Medical Journal of Australasia*, August 20, 1896): The labours of Hertz, Lenard, Crookes, Hittorf, and others led up to Röntgen's discovery. The ordinary Geissler tube was the first step in the process, then came the Crookes tube. This consists of a tube, pear-shaped or otherwise shaped, with platinum terminals fused into opposite ends, and exhausted of air. When a high-tension current from an induction coil is passed through, a violet glow is seen in the tube. If the tube is further exhausted the glow seems to be in bands, and if the tube is still further exhausted the glow disappears, and then the glass of the tube becomes fluorescent, and glows with a bottle-green colour, provided it is made of soda glass. When the tube is in this condition the X rays are given off from the cathode.

The late Professor Hertz was engaged in investigating this phenomenon produced in Crookes's tube just before his death, and he instructed his assistant, Lenard, to continue these researches. He ascertained that the cathodic rays would act on a sensitive plate, and also that they would pass through wood, so that he came very close to Röntgen's discovery that these rays would pass through the tissues of the human body, and that some substances were more easily penetrated by them than others—the soft tissues of the body more than the bones, aluminum more than other metals.

What these rays are is not known; all we know is that they travel in straight lines, can not be refracted or polarized, cast a shadow, act on a sensitive plate, pass through objects opaque to light, and cause fluorescence. It has been suggested that they are ultra-violet rays of the spectrum, with which they agree in some respects, though their wave length has not been determined. In this connection, says Dr. Clendinnen, some observations made by himself on the effect produced on colour may be of interest. When taking a photograph by this process of some articles inclosed in a box painted like a tartan plaid, he found that the negative was striated, and comparing the striæ with the colours on the box, he found that they corresponded with the red colours, and it flashed into his mind that these X rays were absorbed by certain colours as light was. He then tried to take a photograph of a picture painted in colours on a half-inch board, and got a contrast result. This, however, was not satisfactory, as the opacity might have been due to the lead in the paint, and the surface was uneven. To obviate this source of fallacy he next took a playing card, the knave of diamonds, and the red colours came out opaque, the rest transparent; then, on the suggestion of Professor Lyle, he tried aniline colours,

soaking blotting-paper in them, and found that red was opaque, blue semi-transparent, and white transparent to the X rays. He then cut pieces of coloured tissue paper into various shapes, so as to recognise the different colours, pink (as he had no red), orange, yellow, green, blue, violet, and white. On passing the X rays through them, he found pink semi-transparent, yellow and orange opaque, green opaque (but not so opaque as the former), blue and violet more transparent, and white quite transparent. These experiments seemed to show that the X rays obeyed some of the laws of ordinary light in that red and yellow are non-actinic.

There are three things required for producing these rays: First, power or current; this may be obtained from Grove, Bunsen, or bichromate cells. Grove's and Bunsen's are the best, as their current is given off more evenly and lasts longer, but the fumes that arise are too pungent for comfort. This is not the case with bichromate cells, but their current is uneven. The number of cells to use must be in proportion to the strength or sparking of the coil. Accumulators may be used—such as Professor Lyle uses—a dynamo, the main, the Tesla coil, and the Wimshurst machine have all been used. Second, a Ruhmkorff induction coil which gives a spark of from two to six inches; this must be in good working order. Third, a vacuum tube. The positive and negative terminals of the battery are to be connected to the coil, and the terminals of the secondary wire of the coil connected to the external terminals of the tube, which is supported on the stand, with the plate lying underneath, face upward. Owing to the capability of these rays of penetrating paper and wood with such ease, we may photograph on the plate inclosed in a box.

Although these rays are invisible in themselves, they stimulate visible fluorescence in certain salts upon which they are allowed to fall. The salts which have been found to fluoresce best are barium platinocyanide and calcium tungstate. The fluorescent screen is made by painting evenly a thick piece of paper, such as drawing paper, with a mixture of gum and glycerin, and then dusting over it before it is quite dry a powder of the salts mentioned. Not only are the shadows cast on this screen, but it is used for shortening the exposure.

It appears from certain experiments made by Mr. J. A. M'Clelland, an account of which is given by Professor J. J. Thomson (*Proceedings of the Royal Society*, No. 360), that the X rays are not homogeneous, but that some of them are absorbed by one set of substances and others by other sets. This lack of homogeneity is the more pronounced the smaller the amount of residual air in the Crookes's tube. Mr. M'Clelland found that with some substances there was no selective absorption, while with others it was very marked. Glass gave none, with mica and paraffin the effect was small, and with fuchsine, eosine, fluorescine, æsculin, and barium sulphide the effect was very decided. With several fluorescent screens the effect was great. Pure water also gave a distinct though smaller effect.

When the X rays first came into use some physicians expected that they would be found to have some physiological action that could be turned to account therapeutically, and especially that they would prove destructive of morbific germs. It seems, however, from De Renzi's experiments (*Gazzetta degli ospedale*, August 30, 1896; *British Medical Journal*, October 31, 1896) that they have no such effect, at least not on the tubercle bacillus, the bacillus of Finkler, or the cholera spirillum.

Dr. P. Bosc (*Nouveau Montpellier médical*, April 25, 1896; *New York Medical Journal*, July 4, 1896), having seen the opinion expressed in print that the curiosities of vision observed in the hysterical might perhaps be due to their perceiving these rays, examined a girl, fifteen years old, who was affected with hemianæsthesia and astasia-abasia, but whose vision seemed normal. Between the Crookes's tube and the girl's eye he placed a broad screen of two thicknesses of black paper. The light was obtained with a Holtz-Carré static machine. Under these conditions, neither he himself nor the girl's mother could see anything. The patient, on the contrary, saw very clearly, and with each eye separately, a light which she said was "like a lamp." As long as the current was passing she saw distinctly; as soon as it was interrupted she could see nothing. At the time of making the interruption Dr. Bosc kept up a production of sparks, so that the girl did not know that he had stopped the current. He remarks that it was curious that the girl's perception of light varied with the luminous intensity of the cathode rays, the tube being the same.

Dr. Frederick S. Kolle, of Brooklyn (*New York Medical Journal*, January 16, 1897), reports that of seven persons with *amaurosis*, subjected to the Röntgen rays, six observed a peculiar shooting-star light, the *Sternschuppenlicht* of the Germans. Four of the patients could count the individual stars, ranging between six and thirty-two in number.

Cancer is one of the diseases in which the X rays have been expected to prove remedial, and possibly they may yet be of advantage in the treatment of some forms of malignant growth.

Dr. V. Despeignes (*Lyon médical*, July 26 and August 9, 1896) reports a case in which they were used in the treatment of *cancer of the stomach*. At first a notable amelioration was observed, but unfortunately it did not continue. The Röntgen rays did, however, continue to diminish the size of the tumour, and at the time of the patient's death it was considerably smaller.

M. Despeignes says that the treatment considerably ameliorated the general condition and prolonged the patient's life for fully two weeks, it absolutely suppressed the pain near the tumour, and, finally, it notably diminished the volume of the growth. He adds, however, that he thinks the amelioration of the general condition was mainly attributable to injections of artificial serum, for when their use was suspended at the patient's request, because they were painful, the general condition became worse. With regard to the cessation of the

pain, when morphine injections ceased to have any further action, it did not seem warrantable, he says, to attribute it to anything but the employment of the Röntgen rays, for from the beginning of the first sitting the pain ceased entirely. Before the employment of the rays the patient had been taking daily doses of 4½ oz. of chloroform water, and very often two pills containing ¼ of a grain of extract of opium, and he frequently had one or two injections of morphine. After the employment of the rays the use of the opium pills was discontinued and only very small quantities of chloroform were given for two or three days. In regard to the diminution of the size of the tumour, says M. Despeignes, the action of the rays was still more distinct. As there was no sectio cadaveris, it was impossible to say what part of the tumour was influenced by the rays, but it is certain, he thinks, that the regression did not take place on the surface alone, but that the action of the rays was felt in the cancer; the epigastric region, which had been very much swollen on the 4th of July, was almost flat at the time of the patient's death, on the 24th. This diminution extended also to the right extremity of the stomach, the part which encircled the left lobe of the liver. When death occurred it was found on palpation and percussion that this lobe of the liver was completely free, and it seemed as if the cancer had entirely disappeared, on that side at least, for, M. Despeignes argues, if the regression had taken place in the stomach only, it is probable that the contrary would have been the case. In the presence of these results, and although the termination was fatal, he asks if there may not be hope, if not of recovery, at least of a considerable prolongation of life by employing this treatment if the cancerous affection is not advanced or not progressing rapidly.

On the other hand, some observers have put on record certain pathological phenomena that are thought to have been produced by the X rays. In the *New York Medical Journal* for August 29, 1896, an editorial writer says: "So far as our knowledge goes at present, these morbid results seem to affect chiefly if not exclusively the skin and its appendages. Dr. Marcuse (*Deutsche medicinische Wochenschrift*, July 23, 1896; *British Medical Journal*, August 15, 1896) relates the case of a lad, seventeen years old, on whom he experimented with the Röntgen rays once or twice a day for a period of four weeks, the sittings lasting from five to ten minutes, and longer when the chest was being illuminated. Hittorf's tube was sometimes placed close to the body and never more than eight or ten inches away from it. The heat from the tube is said to have been very slight. The lad was completely clothed when his head was undergoing examination, and wore his shirt when his chest was subjected to the apparatus. At first a slight diffuse redness was observed in one half of the face, especially above the ear, with some desquamation. Subsequently there was a sharply defined area above the ear where the hair was very thin. The hairs could be plucked out without pain, and showed signs of degeneration—in short, there was incipient alopecia. There was pronounced injection of the conjunctiva of the eye that was situated on that side of the face that was affected. On the back there was a space 'as large as a plate' over which the epidermis was completely separated, and the exposed corium showed hæmorrhages and exudation. The patch was quite tender, but there had been no pain until shortly before the lesions were noticed. There were similar changes, but not so advanced, over a space of about the same size on the front of the chest. The dermatitis resembled that caused by a burn. From other sources we hear of loss of the nails as a result of exposure to the X rays."

Dr. A. B. Kibbe, of Seattle, Washington (*New York Medical Journal*, January 16, 1897), reports that during a certain week he devoted considerable time to experimenting with an X-ray apparatus. In general, the current strength used was about ten ampères.

He found that the most convenient manner of testing the working of the tube was by using his left hand in front of the fluoroscope, and this he did frequently; but as this method gave less sharp and well-defined pictures than by using a sensitive plate and taking pictures, the fluoroscope was solely used to test the activity of the tube in producing the radiations, and, when the latter were satisfactory, pictures of the hand, wrist, and arm were taken with exposures varying from thirty seconds to five minutes. Just how often the hands were exposed he is unable to say, but certainly not fewer than twenty times for the left with the fluoroscope, and at least five for the right, placed on the plate holder; in no instance, however, for a longer period than five minutes. In order to obtain a picture of his elbow joint he placed it about four inches below the tube, which was of the ordinary focus pattern, the cathode a cup-shaped aluminum disc, the anode a plate of platinum set at an angle of forty-five degrees to the long axis of the tube. The focus he endeavoured to have directly over the joint. The arm was partly flexed and resting semipronated on the plate holder. A second exposure, lasting seven minutes, was tried a day or two later, and a third, lasting ten minutes, on the evening of the following day. This last was on the 8th of September. At the time a slight tingling of the skin was noticed, so slight, however, that he was not certain that it was not due to the effects of imagination, as during the "sitting" he had been going over, mentally, Tesla's arguments in favour of the assumption that the so-called rays are really due to minute particles thrown off from the cathode. In each instance the arm was covered with his usual clothing, consisting of heavy woollen underclothing, shirt and coat sleeve.

A day or two later his attention was attracted to the appearance of the dorsal surfaces of both hands by a slight sensation of irritation and itching. At first sight the appearance suggested sunburn, but, as the weather had been cloudy for a number of days, and further,

as his skin had always been more than ordinarily free from any of the common affections —eczema, etc.—he half jokingly attributed it to the X-rays. On September 18th he felt a slight itching near the elbow which had been exposed to the rays, and that night he found an extensive discoloration of the skin, extending from a point two inches above the joint to a distance of about six inches downward toward the wrist, and including about one third the circumference of the arm. In colour it was of a brownish red, punctated at the upper and lower borders and ends and more confluent at the centre. Examination with a lens showed the punctated area to be due to an apparently greater hyperæmia around the hair follicles. No vesicles were apparent, and there appeared to be no tendency to their formation. Pressure caused the redness to disappear to a great extent, but not entirely. There was no sensitiveness, but the temperature was decidedly raised above that of the adjacent healthy skin. Traction on the hairs showed no loosening.

On September 20th, the affection showing no tendency to become worse, Dr. Kibbe cut out a piece of skin, a centimetre square, from the most deeply discoloured area, without using a local anæsthetic, for he feared to interfere with the structures by injecting cocaine. The stratum corneum was apparently unchanged; the stratum lucidum was not clearly visible, excepting over small areas, where the underlying disturbance was seen to be slight. The outer layers of the cells composing the rete mucosum presented the most striking alterations, particularly in their nuclei. Taking the stain both with hæmatoxylin and lithium carmin very feebly, the nuclei showed in addition a peculiar granular change, which was first indicated in those retaining a more normal reaction to the stain by the formation of a fine nucleolus, which could be seen here and there in the process of division. Near the stratum granulosum the bodies of the cells were apparently becoming converted into keratohyalin as a first step to the increase in bulk, as it were, of the stratum granulosum by a development in their interior of coarse granules, staining deeply with hæmatoxylin, and also with carmin. With the former they appeared like blotches of India ink; in some places giving the impression as though the cells had been charred by heat. This was particularly the case around the hair follicles. The corium exhibited the ordinary changes found in a mild dermatitis: capillary dilatation, with collections of round cells scattered through its structure, particularly around the hair follicles. No extravasations of blood were noticed.

On October 3d Dr. Kibbe noted that desquamation of the entire discoloured area on his arm was going on, with absolutely no pain, excepting in the locality from which the skin had been exsected. A slight itching was all that now annoyed him. Where the flakes had been detached the hairs seemed to be as abundant and as firm as in the healthy skin. There appeared to have been no interference with the healing process of the raw surface produced by the exsection, further than what might have been expected in removing a piece of skin over a joint where every movement would tend to delay cicatrization.

He suggests that the few reported instances of pathological phenomena produced by the X-rays are to be regarded as due to individual susceptibility.

XYLENE, or *xylol*, or *dimethylbenzene*, $C_6H_4(CH_3)_2$, is a colourless liquid resembling benzene in general properties. Some years ago it had a temporary repute in the treatment of *small-pox*. Given internally, in quantities not exceeding 45 minims a day in divided doses, it was supposed to mitigate the severity of the disease and to shorten its course. It is reputed to be *antiseptic*.

XYLENOL.—There are four isomeric xylenols, three of which, *orthoxylenol*, *metaxylenol*, and *paraxylenol*, are used in medicine, chiefly in the form of salicylates, the *xylenolsalols*, in doses of from 2 to 6 grains. The indications for their employment are the same as for that of salol (*q. v.*).

XYLOL.—See Xylene.

YARROW.—See Achillea.

YEAST.—Beer yeast, or brewer's yeast, *cerevisiæ fermentum* (Br. Ph.), is a frothy, semifluid substance somewhat resembling soft soap in appearance, having a peculiar sourish odour and a bitter taste, consisting of the cells of *Saccharomyces cerevisiæ*.

Brewer's yeast is occasionally used in medicine, in doses of one or two tablespoonfuls three times a day. Its employment in this way has been found to prevent the recurrence of *boils*. It may be given in a glass of beer at meal times.

Dr. Cassaët (*Semaine médicale*, August 21, 1895; *British Medical Journal*, August 31, 1895; *Therapeutic Gazette*, December 16, 1895) reports good results in three cases of *diabetes* from the administration of brewer's yeast in daily amounts of an ounce, although the administration of the substance could not be continued long, on account of the practical difficulty in summer of preventing acetous or putrid fermentation. It was taken readily by the patients. The immediate effect was the expulsion, during the few minutes following its absorption, of a very large quantity of gas by eructation; then in the course of the first or second day extremely fœtid diarrhœa with abundant gas occurred. After a few days tolerance was established, and the patient felt better than he had felt for a long time; his general state improved, his appetite returned, his strength increased, and pain diminished. The weight of the three patients on whom the treatment was tried increased three, five, and eight pounds respectively after the yeast had been administered for a fortnight. The gain in weight was particularly remarkable, inasmuch as one of them was phthisical as well as diabetic, and another had diabetes of the grav-

est type. On discontinuing the treatment loss of weight was soon observed again. As to the strength as tested by the dynamometer, an improvement of from twelve to twenty kilogrammes was noted in the right hand and of from seventeen to twenty-two in the left. The urea remained stationary or increased and the proportion of sugar in the urine diminished, in one case by three fourths and in another by two thirds in the fortnight.

Brewer's yeast is used externally in the form of a poultice, *cataplasma fermenti* (Br. Ph.), made by mixing 6 fl. oz. of the yeast with its own bulk of water heated to 100° F., stirring in 14 oz. of wheaten flour, and keeping the mass in a warm place until it rises. This poultice gives off carbonic-acid gas, and thus proves *stimulant* and slightly *anodyne*. There are, however, other and better means of accomplishing all that it can effect.

Baker's yeast, or German yeast, yeast freed from water and pressed into cakes, has been used in the treatment of *enteroptosis* by Dr. A. Günzburg (*Münchener medicinische Wochenschrift*, July 7, 1896; *Presse médicale*, August 19, 1896) in a large number of cases, with successful results. Every day a quantity of about the size of a bean was given, and the fermentation provoked by the yeast caused a certain degree of flatulence which held and immobilized the intestine. Occasionally this flatulence became too great and provoked a feeling of distention; in this case the quantity of yeast had to be diminished.

In a general manner, says Günzburg, this treatment gives the patients a sensation of comfort. They are no longer inconvenienced with flatus, and this is attributed by the author to the peculiar action on the intestine of the carbonic acid which, under the influence of the yeast, is developed in the digestive tract. The stools become regular and abundant, and the distention of the intestine carries the aorta away from the abdominal wall so that the patients do not feel the beating of this vessel. Finally, the appetite becomes better and large quantities of food can be taken without difficulty.

Yeast is one of the sources of nuclein (*q. v.*).

YELLOW ROOT.—See HYDRASTIS.

YERBA SAGRADA.—See LANTANA.

YERBA SANTA, *eriodictyon* (U. S. Ph.), is the leaves of *Eriodictyon glutinosum* (or *californicum*), or Californian tar-bush, a hydrophyllaceous plant. Yerba santa has some reputation as a means of palliating *chronic pulmonary inflammations*. The dose of the fluid extract, *extractum eriodictyi fluidum* (U. S. Ph.), is from 20 minims to a fl. drachm. The aromatic syrup of yerba santa, *syrupus eriodictyi aromaticus* (Nat. Form.), is employed as a vehicle to mask the taste of quinine and other bitter drugs.

ZEA.—See CORN-SILK.

ZINC, *zincum* (U. S. Ph., Br. Ph.).—This metal is not itself used in medicine, but is official for pharmaceutical purposes. It is described as "a bluish-white metal showing a crystalline fracture and having a specific gravity ranging from 6·9 when cast to 7·2 after it is rolled. Soluble in dilute sulphuric or hydrochloric acid with evolution of hydrogen gas." It has a peculiar taste and a slight odour when rubbed. It is to be found in the market in the form of thin sheets or of irregular, granular pieces, *zincum granulatum* (Br. Ph.), or in a fine powder, or moulded into pencils.

For therapeutical purposes, zinc is represented by several official and a large number of unofficial salts which present nearly every phase of activity in direct proportion to their solubility and power of diffusion, a variation which causes very marked differences in their physiological action. In moderate doses the soluble salts determine emesis which, though less severe than that induced by the salts of copper, is very prompt and thorough, while the insoluble salts tend to allay irritation of the gastro-intestinal tract. In regard to the latter, however, it must be noted that large doses often cause nausea and vomiting, possibly on account of the conversion of a portion into a more soluble salt on contact with the contents of the stomach. Almost all the salts are astringent, and the soluble ones are caustic and corrosive agents which in large doses produce severe gastro-enteritis with all the accompanying symptoms of irritant poisoning. When applied externally, the insoluble compounds form soothing and protective dressings to irritated surfaces, while the soluble ones are astringent, irritant, and even caustic.

In medicinal doses the zinc salts act as a *tonic upon the nervous system* and exert a certain, not very powerful, influence to ameliorate spasmodic nervous disorders, such as *chorea* and *epilepsy*. It is probable that at some time between the moment of ingestion and that of absorption into the system these salts are changed into the form of an albuminate, and as such exist and are carried about in the blood. Zinc has a tendency to accumulation, though to a lesser degree than mercury, lead, or copper, and is excreted from the system more rapidly than those metals. The elimination of the drug is accomplished principally by the liver and intestinal glands, but it has been alleged that it is excreted to a slight degree by the kidneys.

The long-continued ingestion of considerable quantities of zinc, whether given for medicinal purposes or inhaled in the form of fumes of the molten metal, may give rise to disturbances of the nervous, respiratory, digestive, and hæmatopoietic systems, characterized by headache, muscular tremor, feebleness, paresis or paralysis, cough, dyspnœa, hæmoptysis, vomiting, diarrhœa or constipation, colic, cramps, anæmia, and other symptoms of interference with the nutrition of the body. The treatment of this condition of *chronic zinc poisoning* is to hasten the elimination of the metal by means of potassic iodide, laxatives, and warm baths.

Dr. Stephen J. Maher, of New Haven, de-

scribes in the *New York Medical Journal* for December 21, 1895, under the name of "spelter shakes," attacks of severe chills followed by fever and profuse perspiration, common among workmen in brass-foundries, and attributed by them to the inhalation of the fumes of molten zinc. These chills are said not to be associated with headache, nausea, or vomiting, and not to exhibit any periodicity or tendency to recurrence except on renewed exposure. As the workmen know that the attacks are of brief duration and consider them without danger, they are not accustomed to summon medical assistance, but endeavour to obtain sleep as quickly as possible, for which purpose it is customary to imbibe considerable whisky. After a few hours they awake exhausted, but otherwise recovered.

Cases of *acute poisoning by the soluble zinc salts* exhibit either the toxic symptoms referable to the acid with which the zinc is combined or the usual characteristics of corrosive poisoning. In the former case the patient is to be treated for poisoning by the combined acid; in the latter the acute symptoms must be relieved by washing out the stomach and the administration of bicarbonate of sodium or some other alkaline carbonate, as the best chemical antidote, followed by the ingestion of demulcents, such as milk or flour and water, together with the hypodermic injection of morphine in sufficient quantity to control the pain and vomiting. When an alkaline carbonate can not otherwise be quickly obtained, it is a good method to dissolve soap in water and cause that to be drank.

Solutions of the soluble salts are useful for purposes of disinfection in the same manner as most soluble metallic salts and are preferred to many because they do not stain.

The therapeutic applications of the zinc salts are as varied as might be inferred from a consideration of their widely different physiological actions. In suitable doses they agree in producing a beneficial effect upon certain diseases of the nervous system which is superior to that induced by the salts of any other heavy metal, though not equal to that of the bromides, which have superseded them in the treatment of such diseases. Aside from this property, there is but little agreement in their action, and each salt needs a separate consideration.

The zinc salts which are official in the United States, Great Britain, or Germany are the acetate, bromide, carbonate, chloride, iodide, oxide, phosphide, sulphate, and valerianate. These will be considered first, the description of each taken from the U. S. Ph., and will be followed by a number of unofficial salts, some of which are but little used, while others are employed to a considerable extent. All which are not permanent in the air should be kept in small, well-stoppered bottles.

Zinc acetate, *zinci acetas* (U. S. Ph., Br. Ph.), *zincum aceticum* (Ger. Ph.).—This salt occurs in "soft, white, six-sided, monoclinic plates of a pearly lustre, having a faintly acetous odour and an astringent metallic taste. Exposed to the air, the salt gradually effloresces and loses some of its acid." It is soluble in about three parts of water and thirty-six of alcohol at ordinary temperatures, in about one and a half part of boiling water, and in three parts of boiling alcohol. When subjected to protracted boiling in water, it is rendered less soluble, a portion of the acid being lost and a basic salt formed.

Zinc acetate is seldom employed for internal administration, though it has been used as a *nervine* and to check *diarrhœas*. In doses of from 8 to 30 grains it is an efficient *emetic*. Its principal use is as a local astringent, particularly in *gonorrhœa*, *leucorrhœa*, and *conjunctivitis*, where its action is essentially the same as that of the sulphate, though somewhat less irritating. As a collyrium, it is usually prescribed in the strength of from ½ to 4 grains to the ounce of water, a drop of which is to be instilled into the eye once a day or oftener. Like all astringent collyria, this should be used only in conjunctivitis, and will do harm in certain diseases of the eye which are frequently distinguished with some difficulty from that disease, such as keratitis, iritis, or scleritis.

Solutions of about the same strength are used as injections in gonorrhœa, after the acute symptoms have abated, and also in leucorrhœa. Sir Astley Cooper recommended in gonorrhœa a solution of zinc sulphate and lead acetate, in which a double decomposition ensued and resulted in the production of zinc acetate and lead sulphate. This is not infrequently useful, as the astringent action of the zinc salt is complemented by the protection afforded to the urethral mucous membrane by a coating of the insoluble lead sulphate.

An ointment containing zinc acetate is frequently useful in *erythema* and *herpes*. The late Dr. Tilbury Fox recommended as an astringent wash in erythema and eczema the following:

℞ Zinc acetate..... 2 grains;
Rose water..... 1 fl. oz.
M.

Zinc bromide, *zinci bromidum* (U. S. Ph.), occurs as a white granular powder, odourless, and having a sharp saline and metallic taste. It is very deliquescent, and is freely soluble in water and in alcohol.

This salt is very little used. It was probably introduced into medicine for the purpose of combining the tonic effect of zinc upon the nervous system with the sedative action of the bromides, but it has not proved of special efficacy in the treatment of nervous diseases. It is said to have been used in *epilepsy* in doses of from 1 to 25 grains, but Gowers appears to have voiced the general opinion when he stated that it seemed of small value and to be badly borne. The dose usually recommended is from ½ to 2 grains.

Zinc carbonate.—This salt is found in an impure condition in Nature as a mineral which is usually amorphous, but sometimes crystalline, and varies in colour from white to red or green. This mineral, when powdered, is one of the oldest local remedies we possess, commonly known as *calamine*, or *tutty*, and forms

an important ingredient of calamine ointment, which was formerly a favourite dressing for *abrasions* and *superficial cutaneous inflammations* and diseases.

The place of calamine has been taken in modern therapeutics by the precipitated zinc carbonate, *zinci carbonas præcipitatus* (U. S. Ph.), *zinci carbonas* (Br. Ph.), which is made by the interaction of zinc sulphate and sodium carbonate. It is "an impalpable white powder of somewhat variable chemical composition, without odour or taste. Permanent in the air. Insoluble in water or alcohol; soluble in diluted acids with copious effervescence." When strongly heated it loses water and carbon dioxide, leaving a residue of zinc oxide.

Zinc carbonate may be given in small doses to allay *vomiting* and *irritation of the gastro-intestinal tract*, but is seldom used for this purpose. It is slightly *astringent* and is useful as a surgical dressing, particularly for *superficial inflammations* which need a slight stimulation in addition to protection from the air. For this purpose it may be used as a dry powder, in a lotion, or in an ointment. The powder is also used to dust upon cutaneous surfaces which are in apposition with each other, as a prophylaxis against *intertrigo*.

A lotion recommended by Crocker in acute inflammatory conditions of the skin is:

℞ Precipitated zinc carbonate. 8 scruples;
Zinc oxide..... 4 drachms;
Glycerin..... 2 fl. drachms;
Rose water, enough to make 3 fl. oz.
M.

A good ointment for most purposes is this:

℞ Precipitated zinc carbonate. 2 drachms;
Lard ointment..... 10 "
M.

Zinc chloride, *zinci chloridum* (U. S. Ph., Br. Ph.), *zincum chloratum* (Ger. Ph.), occurs as a white granular powder or in porcelainlike masses, irregular, or moulded into pencils, odourless, of such intensely caustic properties as to make tasting dangerous, unless the salt is dissolved in much water, when it has an astringent, metallic taste. It is very deliquescent. It is soluble in 0·3 part of water at 15° C. (59° F.), forming a clear solution which, on protracted boiling, deposits a basic salt. It is very soluble in alcohol, less soluble in ether, and has an acid reaction.

An impure zinc chloride was obtained and described by Glauber in 1648, and another impure form was described as "butter of zinc' by Hellot in 1735.

When applied to the denuded tissues of the body, this salt exhibits a great affinity for the water there present, coagulates the albumin, shrivels the blood-vessels, and converts the whole into a dry, grayish, odourless mass, or eschar, which is thrown off in a week or two by the living tissue beneath. The coagulation of the albumin of the destroyed tissue serves to form a barrier which limits the caustic action of the salt and prevents its deeper penetration. When zinc chloride is thus applied to living tissue it causes pain for from six to eight hours, which, though said to be less severe than that occasioned by arsenic or corrosive sublimate, is sufficiently intense.

Internally, the action of zinc chloride in small doses is that of a weak *nerve tonic*, but larger quantities produce the symptoms of acute irritant poisoning, the treatment for which has already been described. It is not often used for internal medication, but when such administration is desired it is best to dissolve the salt in spirit of ether, in the proportion of a drachm to an ounce. Of this solution from 4 to 8 minims may be given twice a day. It has been alleged that in the early stage of *pulmonary tuberculosis* hypodermic injections of a solution of this salt tend to promote the formation of fibrous tissue and check the progress of the disease. It is recommended to be given in doses of 3 minims every three or four days, for five or six times, and it is stated that no objectionable local or constitutional effects are produced by such administration.

The *escharotic*, or perhaps it might better be called *mummifying*, property of zinc chloride has been made use of for the removal of *malignant* and other *morbid growths*, such as *nævi*, *warts*, and *condylomata*, to destroy "*inoperable*" *aneurysms*, to open *abscesses* in situations where puncture or incision would be dangerous, and to cleanse the surfaces of *gangrenous ulcers*. The absence of danger of absorption of the drug and the natural limitation of its caustic action, together with its power, render it one of the most useful agents which we possess for the purpose of removing neoplasms, but the advisability of using any such agent for the removal of cancerous growths when extirpation with the knife is possible is very questionable. Although the pain caused by the caustic action of zinc chloride is considered to be less than that occasioned by other powerful caustics, it is nevertheless far greater than that of excision, even when performed without anæsthesia, and it is doubtful if the statements of those who maintain its superior efficacy can be substantiated. It has no selective affinity for the diseased rather than the healthy tissue, but destroys both alike, and the complete extirpation of a cancerous growth certainly appears to be as likely to prove curative when performed with a knife as when done by the chemical action of a caustic. Sometimes and for various reasons excisions of a malignant tumour is impracticable, and then in a certain number of cases this method of removal is valuable.

A certain amount of danger, albeit very small, attends the use of zinc chloride as a caustic for the purpose of removing cancerous growths, as is demonstrated by a case reported by Dr. Nichols in the *Boston Medical and Surgical Journal*. An epithelioma of the lip was first washed with a solution of caustic potash, and then a paste containing nearly 25 per cent. of zinc chloride was applied. This caused great pain in the growth, followed by pain in the region of the stomach, and then succeeded by unconsciousness, stertorous breathing, dilated and fixed pupils, a

small and weak pulse of 110, flushed face, cold perspiration, convulsions, coma, and death in about eight hours. The autopsy failed to reveal any internal lesions which could account for the sudden death.

The epithelium acts in a measure as a protection against the action of this salt upon the subepithelial structures, so when zinc chloride is to be used for the purpose of removing morbid growths the cuticle, if present, should first be removed by means of acid nitrate of mercury or by a blister, and the preparation should then be applied to the raw surface. The saturated solution has been used for this purpose, but usually the salt is applied in the form of a paste of a strength proportioned to the situation and depth of the growth which it is desired to extirpate.

The oldest, and perhaps best known, paste is *Canquoin's*, which is made by mixing zinc chloride with wheaten flour in proportions which vary from one to two to one to five, and adding a sufficient quantity of water to make a paste. This is to be applied to the denuded surface, which should be surrounded by some protective covering to the neighbouring skin, such as a thick layer of simple cerate saturated with chloroform, which serves this purpose very well. The paste is applied from one twelfth to one third of an inch in thickness and allowed to remain several hours, both the thickness and the length of time to be determined by the depth to which it is desired that the caustic action should penetrate. After removal of the eschar, renewed applications are necessary until the neoplasm has been removed. The paste is frequently moulded into pointed pieces, known as "caustic arrows," which are plunged into the substance of large tumours to secure their removal.

Other pastes have been recommended which differ from Canquoin's in that they contain various admixtures of other drugs or are made with other diluents than flour, such as anhydrous sulphate of calcium, gutta-percha, gluten, and zinc oxide, but all are used in the same manner, and with the same precautions, to accomplish the same purpose and present very few practical differences. But another method of applying zinc chloride for its caustic action is that of Cooke, in which lint is saturated with the deliquesced salt, cut into pieces of the size required and applied in a similar manner as the paste.

Zinc chloride is a very active *antiseptic* and *disinfectant*. A 5-per-cent. solution is sufficient to destroy most micro-organisms, but a 20-per-cent. solution is necessary for the destruction of anthrax spores. The official solution, *liquor zinci chloridi* (Br. Ph.), contains about 50 per cent. of the salt dissolved in water, and is a clear, colourless liquid of a very astringent, sweetish taste and acid reaction. *Burnett's disinfecting fluid* is a similar but somewhat stronger preparation. Both are useful as disinfectants and deodorizers for sinks, water-closets, drains, and other places where such an agent is needed. They are dangerous poisons, and fatal results have been occasioned by their ingestion.

Useful antiseptic lotions for suppurating wounds and putrid ulcers may be made by diluting the official solution to the strength of from 2 to 10 minims in an ounce of water. Such a lotion serves to cleanse the surface, and will not infrequently stimulate old and indolent ulcers to a condition of healthy activity and repair. A stronger solution is useful for the irrigation of dissection wounds.

Small cystic tumours, *ganglia*, *ranulæ*, and *nasal polypi* have been injected with weak solutions of zinc chloride in order to destroy them, but this is not usually so satisfactory a method of treatment as removal by the ordinary surgical procedures. Polaillon asserts that he has obtained as good results in the treatment of *hydrocele* by the injection of weak solutions of zinc chloride as from the similar use of tincture of iodine, and that less pain is caused by the former.

[M. Léon Derville (*Journal des sciences médicales de Lille*, January 18, 1896; *New York Medical Journal*, February 22, 1896) describes a mode of treating *lupus* when it is in the form of isolated nodules by what he calls dilaceration followed by applications of zinc chloride. The procedure is as follows: A scarificator is introduced into the centre of the tubercle and pushed until it is arrested by the cicatricial tissue which surrounds the lupous nodule; a rotatory movement is then rapidly made which tears the tuberculous tissue and often removes fragments at the same time. Employed in this manner, says the author, it not only dilacerates the diseased tissue, but it removes a part of it in the same way as a sharp curette does.

After the tubercle has been torn away, a small crystal of zinc chloride is put into the little cavity, and almost immediately the bleeding stops. A small black patch then forms, and this is surrounded by a whitish circle, a small eschar. This becomes dry and forms a crust over the lesion, and under it cicatrization takes place. This crust usually falls off between the tenth and the fifteenth day, leaving only a reddish mark.

The advantages of this process, says M. Derville, are the following: 1. It is scarcely painful, and consequently is well borne by the patients. 2. It does not interfere with the patient's occupation; it leaves a few crusts only on the face, and does not require any dressing. 3. It gives rapid results. It is not rare to see a small nodule destroyed at the first application and replaced by a sclerotic tissue which, by becoming retracted, can have only the most favourable influence on the surrounding tissue.

The disadvantages are that zinc chloride leaves cicatrices, often irregular and prominent, but this, says M. Derville, is of slight importance if they are on the body, but on the face they become deformities, and for this reason it should not be employed on the latter. Another disadvantage is the sclerotic action of zinc chloride on the tissue, which, by becoming shrivelled, may cause a shrinking of the natural orifices. If the nodules are situated near the mouth or the nostrils, says the au-

thor, other procedures are preferable, except in cases in which the lupous patches are very small.

M. Derville says that he does not maintain the absolute efficacy of this treatment, for recovery after a single application can not be hoped for unless the tubercles are superficial and not very extensive. When they are, the treatment has to be repeated several times. Usually an interval of two weeks should elapse between the applications; at the end of this time the crusts fall off or are easily detached, and dilaceration and cauterization may be resorted to again. This procedure, he says, if used prudently in the beginning, may be of some use in practice: it may cut short a long and tiresome treatment, and also rapidly check a relapse in the same region.]

In *diphtheria* Wilhelmy recommends the local application of a 20-per-cent. solution on pledgets of cotton to the false membrane on the tonsils and pharyngeal walls. This secures the removal of the false membrane and, though it causes severe pain, the treatment is said to be remarkably efficacious.

Solutions of from 15 to 60 grains to the ounce are useful local applications in cases of *chronic pharyngitis*, or, in general terms, to mucous membranes which have undergone fibroid degeneration or show the results of chronic inflammation. In *chronic laryngitis* such applications have occasionally been made to the vocal cords and the epiglottis. A solution of 2 grains to the ounce is sometimes useful for the purpose of irrigation in cases of *empyema of the accessory nasal sinuses*, as well as in *chronic suppurative otitis media*.

Solutions of from ½ to 2 grains to the ounce of water have been used in *chronic conjunctivitis*, and, according to some authors, may be advantageously alternated with silver nitrate in the treatment of *trachoma*. Zinc chloride has also been used in *gonorrhœal* and *diphtheritic conjunctivitis*, but if used at all in conjunctival diseases, it should be with great caution and in very weak solutions. The same caution should be observed in its use as an injection in *gonorrhœa* and *leucorrhœa*, for which purpose it is sometimes employed.

Zinc iodide, *zinci iodidum* (U. S. Ph.), occurs as a white, granular powder, odourless and having a sharp saline and metallic taste. It is of acid reaction, very deliquescent, and apt to absorb oxygen from the air and to acquire the colour of the iodine thus liberated. It is readily soluble in water, alcohol, or ether.

Zinc iodide has not become a popular drug. It has been given internally in *chorea* and in *scrofulous diseases of the skin* and *eyes*, but not with especially brilliant results. For this purpose it is best administered dissolved in syrup, in doses of from ½ grain upward.

It possesses caustic properties which, though not so powerful, closely resemble those of the chloride, but it is seldom, if ever, used as a substitute for that salt.

In the form of a 10-per-cent. ointment, it has been used as a substitute for potassic iodide to promote the resorption of *tumours*, but it does not appear to possess any advantage over the potassic salt as a sorbefacient.

The best results obtained from the use of zinc iodide have been in the treatment of *chronic inflammations of the mucous membranes*. Thus a 3-per-cent. solution may be used as a lotion in *post-nasal catarrh*, and Lefferts considers that a nascent zinc iodide, made by the addition of a mixture of 240 grains of potassic iodide, 480 grains of iodine, and 3 drachms of water, drop by drop, to 200 grains of zinc sulphate and 140 minims of distilled water, forms an escharotic well adapted for use in the throat and nose. Solutions of zinc iodide have been successfully used to reduce the size of *chronically enlarged tonsils*. In 1859 Lente recommended the application of a solution of from 5 to 10 grains to the ounce to be thrown against the mucous membrane at the mouth of the Eustachian tube, in cases of its catarrhal swelling, for its astringent effect. He says that it is as efficacious as silver nitrate, which is frequently used for this purpose, and at the same time possesses a less disagreeable and persistent taste.

In *chronic conjunctivitis* a ¼-of-1-per-cent. solution has been employed as a collyrium.

The following ointment may be of service in *acne*:

℞ Zinc iodide..... 5 grains;
Vaseline..... 1 oz.
M.

The official **zinc oleate,** *oleatum zinci* (U. S. Ph., Br. Ph.), is composed of five parts of zinc oxide in ninety-five parts of oleic acid, and consists of a fine pearl-coloured powder, soft and soaplike to the touch. This preparation is useful in cutaneous diseases where ointments are not well borne, and is recommended as a useful application in *bromidrosis* and in *hyperidrosis*, particularly of the axillæ, genitals, and feet. With salicylic acid or French chalk it has been used in the treatment of *comedo* and *acute vesicular eczema*. In the combination of one part of zinc oleate to two parts of iodoform, it has been recommended for *erosions of the os uteri*.

[The official ointment of zinc oleate, *unguentum zinci oleati* (Br. Ph.), consists of equal parts by weight of zinc oleate and soft paraffin.]

Zinc oxide, *zinci oxidum* (U. S. Ph., Br. Ph.), *zincum oxydatum* (Ger. Ph.), is an amorphous white powder without odour or taste. It gradually absorbs carbon dioxide from the air. It is insoluble in water or in alcohol, but soluble without effervescence in diluted acids and in ammonia water.

This salt of zinc is found in Nature combined with the red oxide of manganese to form the mineral zincite. It is known in commerce as zinc white.

Although zinc oxide is insoluble in the ordinary solvents, it is certain that some portion does enter into the circulation after ingestion into the stomach, and it is probable that a chemical change takes place in the salt on contact with the contents of that viscus, which converts a portion into a more soluble salt.

Possibly this conversion is into the albuminate, or perhaps into the lactate or chloride, which may be in turn changed into the albuminate. But whatever may be the nature of the chemical changes which take place, the absorption of zinc into the system after ingestion of the oxide is proved by the appearance of physiological symptoms after repeated doses. The experiments of D'Amore, Falcone, and Maramaldi have demonstrated that sufficiently large doses, steadily repeated, will cause intoxication and death, at least in dogs. They gave these animals 7½ grains of zinc oxide by the mouth daily, and noted as results the following symptoms: Vomiting, feebleness, great emaciation, partial loss of sensation, a diminution in the number of the red blood-corpuscles, and a lessened excretion of urine, which was found to contain albumin, sugar, zinc, and blood. The dogs lived from ten to fifteen days, and the post-mortem examination revealed extreme pallor everywhere, with disseminated areas of fatty degeneration in the liver, kidneys, and pancreas, surrounded by vascular and interstitial disturbances. The most marked lesions of the central nervous system were atrophy of the cells of the anterior cornua of the spinal cord, with some swelling of the nuclei.

In medicinal doses, zinc oxide acts as a mild intestinal *astringent* and *nerve tonic*. In combination with bismuth and pepsin, it has proved an excellent remedy for the *summer diarrhœa of children*. Combined with carminatives and morphine, it is efficacious in *gastralgia*. It has had a fair trial in *epilepsy* and other nervous diseases, and, while it is as good as any zinc compound and better than a salt of any other metal, it is really of little value. Bartholow considers that the cases of epilepsy in which this drug is most efficient are those in which the disease is the result of peripheral irritation, having its origin in the stomach. The same author believes zinc oxide to be of prophylactic value in *spasmodic asthma*. Benefit is said to have been obtained from its use in the *muscular tremor* and *unsteadiness* of *chronic alcoholism* or *poisoning with mercury* and *arsenic*. It has also been used in doses of about 3 grains to check the *night sweats of phthisis* and the profuse secretion of *bronchorrhœa*.

Zinc oxide is much used as an ingredient in cosmetics, but when so employed is apt to injure the skin.

The principal medicinal value of zinc oxide is as a protective, slightly astringent dressing for cutaneous affections, such as *abrasions*, *excoriations*, *blisters*, *burns*, *fissures* of the nipples, lips, and other parts of the body, *intertrigo*, *herpes*, and *eczema*. For this purpose it is used in the form of powders, ointments, pastes, and lotions. As a powder, it may be used pure, but in certain diseases, such as erythematous and vesicular eczema, it is frequently too astringent and needs to be diluted with some inert powder, such as lycopodium, kaolin, or starch.

Sometimes in eczematous inflammation of the eyelids, especially when due to irritating discharges from the eyes, as in the *scrofulous conjunctivitis of children*, a powder containing zinc oxide is an efficient application. Occasionally a powder 20 per cent. in strength may be applied to the conjunctiva.

The following has been pronounced useful in *acute eczema of the auricle* and also as an application to *ulcers of the sæptum nasi*:

℞ Zinc oxide..... 1 drachm;
Alum, Starch, each..... 1 oz.
M.

The powdered zinc oxide has also been used, either pure or mixed with alum or tannin, for insufflation into the larynx in cases of *laryngitis*.

The official ointment, *unguentum zinci oxidi* (U. S. Ph.), *unguentum zinci* (Br. Ph., Ger. Ph.), was first brought into use by Sir Erasmus Wilson. That of the U. S. Ph. is composed of 20 parts of zinc oxide with 80 of benzoinated lard; that of the Br. Ph., of 2 parts of zinc oxide and 11 of benzoated lard; and that of the Ger. Ph., of 1 part of crude zinc oxide, *zincum oxydatum crudum* (Ger. Ph.), and 9 parts of lard. This has long been a favourite ointment in cutaneous diseases, and frequently other drugs, such as carbolic acid, tar, and oil of cade, are incorporated with it for their medicinal effect. Other ointments than the official may be made by varying the proportion of the lard, or by using some other fatty excipient, such as vaseline or lanolin. When a non-fatty excipient is chosen, the preparation may be known as a paste, and is a useful substitute for the ointment in hot weather or when a fatty excipient is disagreeable. A good example of such a paste is the following:

℞ Zinc oxide..... 50 parts;
Salicylic acid, Carbolic acid, each..... 6 "
Mucilage of gum arabic, Glycerin, each... 10 "
M.

Neumann recommends in *seborrhœa* and *pityriasis*—

℞ Zinc oxide, Lead carbonate, each... 1 drachm;
Spermaceti..... 1 oz.;
Olive oil, enough to make a soft ointment.

Another which has been recommended for the same purpose is—

℞ Zinc oxide, Honey, each..... 2 scruples;
Yellow wax..... 2 drachms;
Almond oil..... 6 fl. drachms.
M.

Before either of these, or any other paste or ointment which contains zinc oxide, is applied to the scalp, the hair should be cut short.

In the form of a lotion, zinc oxide has sometimes been used as a collyrium in *conjunctivitis*, and the following is recommended as of good

service in dermatitis, irritable acne, and other acute inflammations of the skin:

℞ Zinc oxide..... 2 drachms;
Glycerin..... 2 fl. drachms;
Lead water..... 1½ fl. drachm;
Lime water..... ½ pint.
M.

For use in *gonorrhœa*, it has been suggested to mix the salt with lanolin or some other bland oil, and to allow it to remain for some time in the urethra.

Zinc oxide has also been recommended as a component of firm surgical dressings. When it is mixed with the chloride and made into a paste, the basic oxychloride is formed, which will be mentioned later. A 10-per-cent. paste made with equal parts of glycerin, gelatin, and water is recommended by Unna to be rubbed into a bandage which is immediately applied. As the mixture dries, it hardens and incases the limb bandaged in a stiff, immovable dressing.

Zinc phosphide, *zinci phosphidum* (U. S. Ph.), is a gritty powder of a dark-gray colour, or crystalline fragments of a dark, metallic lustre, having a faint odour and taste of phosphorus. In contact with the air it slowly emits phosphorus vapour. It is insoluble in water or in alcohol, but soluble in diluted hydrochloric or sulphuric acid, with the evolution of hydrogen phosphide.

This salt has been recommended by Reclus as very satisfactory in some cases of *lymphadenoma*. It is readily decomposed in the stomach, and the physiological effects produced by its administration are those of phosphorus, of which, rather than of zinc, it should be considered a preparation.

Zinc sulphate, *zinci sulphas* (U. S. Ph., Br. Ph.), *zincum sulfuricum* (Ger. Ph.), occurs in colourless, transparent rhombic crystals, without odour and having an astringent metallic taste. It effloresces in dry air. It is soluble in 0·6 part of water at 15° C. (59° F.) and in 0·2 part of boiling water, also in about three parts of glycerin. It is insoluble in alcohol.

In small doses given internally, this salt is a *tonic* and *astringent*, in larger quantities an *emetic*, and in still larger an irritant poison. As a tonic it may be used in the same class of nervous diseases as all the other zinc salts, and as an astringent it is sometimes, especially when combined with opium and ipecac, of good effect in *diarrhœa* and *dysentery*. Occasionally it is useful in *bronchorrhœa* and in *dyspepsia*, but, unless benefit is soon obtained, the use of this remedy should not be persisted in. For these purposes the dose is from $\frac{1}{10}$ to 2 grains, preferably in pill form.

Zinc sulphate is a systemic emetic, and causes vomiting when injected into the blood as well as when ingested into the stomach. As it is also but very slightly depressant, it is a valuable emetic for use in *narcotic poisoning* as well as in such diseases as *croup* and *whooping-cough* and whenever simple evacuation of the stomach is desired. To produce emesis it is usual to divide from 3 to 15 grains into several portions and to give one portion every five minutes until vomiting occurs. A curious result of the long-repeated administration of zinc sulphate is that the stomach becomes remarkably tolerant after a time, so that enormous doses may be taken without causing nausea, but the course of treatment necessary to produce this tolerant condition may result in a superficial ulceration of the mucous membrane of the stomach.

When an overdose has been taken the symptoms of irritant poisoning appear and the treatment already described should be instituted. Very few cases of this nature with fatal results are on record.

Solutions of zinc sulphate are very useful for topical applications to mucous membranes, on account of the stimulant and astringent action of the drug. As a collyrium in *conjunctivitis* it is very popular, although rather more irritating than the acetate. It is adapted to chronic rather than acute cases, and should be used in solutions of from ¼ to 4 grains to the ounce of water once a day or oftener. Care should be taken, as with the acetate, not to use such a collyrium in scleritis, iritis, or keratitis, conditions which are frequently distinguished with difficulty from acute conjunctivitis.

Solutions of about the same strength have been applied to the vocal cords to relieve *vocal fatigue*, and may sometimes be of service in *acute coryza*.

Zinc sulphate is an efficient *hæmostatic* when applied to bleeding surfaces, and is of service in checking *epistaxis* when applied in the form of a powder or in a strong solution. A solution of 40 grains to the ounce has been employed by Dr. Bean to arrest *laryngeal hæmorrhage*.

Weak solutions have been employed to irrigate the accessory nasal sinuses in cases of *empyema*, and to cleanse the nasal mucous membrane in *atrophic rhinitis*. In *catarrhal inflammation of the mucous membrane of the Eustachian tube* a solution of 1 to 2 grains to the ounce may be applied to its mouth, and solutions of from 2 to 5 grains to the ounce are frequently useful in acute or chronic cases of *purulent otitis media*. In *inflammation of the external ear* weak solutions of from ¼ of a grain to the ounce upward are sometimes of service, but when furuncles are present in the canal the solution needs to be as strong as from 30 to 60 grains to the ounce in order to be useful.

Many practitioners consider zinc sulphate one of the best remedies for *gonorrhœa* which we possess. It is used as an injection, beginning with a weak solution and increasing the strength as the urethra becomes more tolerant.

When dry powdered zinc sulphate is sprinkled over the surface of an *epithelioma*, *lupus*, or *unhealthy ulcer*, a slough is cast off, but as this salt has not the same power of penetration as the chloride, it is not as efficient for the removal of malignant neoplasms. Sir James Y. Simpson recommended its use in *cancer of the uterus*, but it has not been very generally adopted. It is useful for the purpose of removing *caruncles of the female urethra*, *warts*,

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condylomata, and similar *small neoplasms* or *excrescences*.

Villate's solution has been successfully employed as a local injection for the cure of caries. It consists of—

℞ Copper sulphate, Zinc sulphate,	each...	15 parts;
Lead water.....	30	"
Vinegar.....	200	"

M.

The sinuses which lead to the carious bone are washed out with this solution so as to decalcify and bring away the dead portions. It should not be necessary to state that in necrosis no such solution can be expected to remove a sequestrum unless it is a very small one.

Good results may sometimes be obtained in acne by bathing the surface with a solution of this salt with equal parts of potassium sulphate and resorcin. The late Dr. Tilbury Fox recommended as a lotion in *erythema*, *intertrigo*, and *eczema* the following:

℞ Zinc sulphate.....	10 grains;
Alum.....	20 "
Glycerin.....	1 fl. drachm;
Rose water.....	7½ fl. oz.

M.

In *dermatitis venenata* a solution of 30 grains of zinc sulphate to the ounce of water is said to be an excellent lotion.

Zinc valerianate, *zinci valerianas* (U. S. Ph., Br. Ph.), has already been considered under VALERIAN.

The number of unofficial salts of zinc which are used in medicine is very great. Most of them are not of great importance, but some have won prominence and are quite extensively employed at the present time.

Zinc albuminate.—This combination is the form into which it is supposed that the various other salts are changed in the digestive organs before they enter the circulation, and this preparation has been introduced into medicine with the hope of securing a readier assimilation of the drug. It appears in the form of yellowish scales which are slightly soluble in water. It is intended for internal administration in those diseases in which the use of zinc is indicated.

Zinc arsenate and **zinc arsenite** are two preparations which are on the market, but are very little used. Each is a white powder soluble in acids and in sufficient quantities produce the symptoms of irritant poisoning when taken internally.

Zinc borate, or **tetraborate,** is an amorphous white powder obtained by the interaction of zinc sulphate and sodium biborate in hot water.

This powder has been used to a slight extent in surgical practice, dusted over the surface of wounds for its antiseptic action.

Zinc bromate is a white, deliquescent powder, soluble in an equal part of water. It may be used in the same manner as the preceding, dusted over wounds as an antiseptic powder.

Zinc carbolate is a white powder, slightly soluble in water and alcohol.

This salt is slightly tonic and antiseptic in its action when given internally and has been used in cases of croup, diphtheria, and foul stomach in doses of ¼ to 5 grains. It is also recommended as an antiseptic for surgical dressings and for use in skin diseases.

Zinc chrysophanate is a brownish red powder, readily soluble in slightly alkaline water and in the alkaline secretions of wounds. The latter quality has suggested its availability as a surgical dressing.

Zinc citrate is an amorphous white powder with a sharp metallic taste, not perfectly soluble in water, which has been very slightly used in epilepsy in doses of from 3 to 12 grains.

Zinc cyanide is a snow-white powder, odourless, tasteless, insoluble in water or alcohol, soluble in diluted acids and in solutions of the cyanides of ammonium and potassium. After a while it decomposes and acquires a sweetish, metallic taste.

The physiological action of this salt is very similar to that of hydrocyanic acid and its alkaline compounds, sufficiently so that it is sometimes used therapeutically as a substitute for that drug. It has also been used in the same category of nervous diseases as the other zinc salts with about the same effect. It is frequently useful in *neuralgia*, particularly of the trigeminus, and has been employed to relieve *gastralgia*, *dysmenorrhœa*, and certain *cardiac neuroses* characterized by pain, palpitation, and disordered rhythm. It may be occasionally given in *whooping-cough* with good effect, but should never be continuously administered in that disease.

Formerly zinc cyanide was used in acute articular rheumatism, but it has been superseded by other remedies because benefit is uncertain and its administration is apt to be followed by headache. The drug is also said to be anthelminthic.

The usual dose is from ¼ to 1½ grain repeated as frequently as every hour or two, because the physiological action appears to be transient. See also under CYANOGEN.

Zinc and potassium cyanide.—This salt, which is obtained by dissolving zinc cyanide in a solution of potassium cyanide, occurs in colourless or white octahedrons of a sweet and metallic taste. It is permanent in the air and freely soluble in water.

The physiological action of this salt is the same as that of zinc cyanide, to which it is frequently preferred in therapeutics on account of its greater solubility. It is prescribed in the same doses and may be given very nicely in aromatic sweetened water, but the addition of a small quantity of acid will precipitate zinc cyanide from the solution.

Zinc ferrocyanide is a white, tasteless powder, insoluble in water, alcohol, and diluted acids.

The medicinal properties of this salt are the same as those of the cyanide, and it is used in the same diseases. The usual dose is given as from 1 to 4 grains. A good form of administration is—

℞ Zinc ferrocyanide..... 5 grains;
Magnesia. ..... 40 "
Powdered cinnamon.... 1 drachm.

M. Divide into 10 powders. Sig.: One powder every four hours. See also under CYANOGEN.

Mercury and zinc cyanide.—This is a white powder obtained by precipitation from a solution of potassium and mercury cyanides by means of zinc sulphate, and is probably a mixture rather than a true double cyanide. It was proposed in 1889 by Sir Joseph Lister as a non-irritating, antiseptic, surgical dressing, but was soon declared to be in no way superior to the dressings previously in use. Its germicidal power is said to be slight, but a 1-to-1,200 solution will prevent putrefaction in animal fluids. A ready means of preparing a dressing with mercury and zinc cyanide is said to be to dip gauze impregnated with zinc cyanide into a 1-to-4,000 solution of mercury bichloride. This cyanide may also be used in the form of an ointment in the treatment of *eczema* and other cutaneous diseases, taking the place of the oxide. See also under CYANOGEN.

Zinc gynocardate is a yellowish, granular powder, insoluble in water and dilute acids, readily soluble in alcohol, ether, and chloroform.

This salt has been recommended in the form of an ointment for the treatment of *syphilitic skin diseases*, *psoriasis*, *prurigo*, *leprosy*, and other cutaneous diseases in which gynocardic acid and chaulmoogra oil have been used. (See CHAULMOOGRA OIL.)

Zinc hydrochlorite.—A solution of zinc hydrochlorite is recommended as possessing advantages over the solution of chlorinated soda as an *antiseptic* in that it is not alkaline and is astringent. It may be used as a lotion or as a gargle.

Zinc iodate is a salt, insoluble in water, produced by the union of zinc and iodic acid, which has been used to no great extent as a topical application to affections of the mucous membranes.

Zinc lactate.—This salt occurs in short, quadrangular crystals of an acid reaction and an acidulous metallic taste, obtained by displacing the carbon dioxide of zinc carbonate with lactic acid. It is soluble in fifty-eight parts of cold and six of boiling water, nearly insoluble in alcohol.

This is the most readily tolerated of all the zinc salts, and is therefore preferable to any other for internal administration. It has been used with good results in *hysterical amblyopia*, and is employed in the same class of nervous diseases as the oxide. The usual dose is from ½ to 1 grain several times a day.

Zinc nitrate.—This salt occurs in striated, colourless, pointed, quadrilateral, prismatic crystals, is very deliquescent, is soluble in water and alcohol, and very caustic in its action. Its chief if not its only use is as a caustic in a similar manner to and for the same purposes as the chloride. When mixed with flour and water it forms a paste which can be easily spread, remains soft, and does not contract or spread at the edge through absorption of water. It may also be made into pencils in the same way as the chloride, but they must not be dried by means of heat, as that will cause some decomposition of the salt. The late Dr. Tilbury Fox recommended in severe and chronic cases of *lupus erythematosus* the following:

℞ Zinc nitrate..... 1½ drachm;
Distilled water, }
Glycerite of starch, } each ... 1 "
Flour, }
M.

This is formed into a paste and applied to the surface of the lupus. When the paste is withdrawn a poultice is applied and the raw surface left by the removal of the eschar is dressed with an ointment like diachylon or zinc oxide. Reapplication may be needed, and the strength of the paste may be increased according to circumstances.

Zinc oleostearate.—This is a semifluid, white, creamlike product of the combination of zinc stearate with benzoinated liquid albolene. It is of neutral reaction, almost tasteless, with the odour of benzoin, tenacious to the mucous membrane, to which it is nonirritant and acts as a protective. It is especially intended for use in diseases of the naso-pharynx, pharynx, and larynx, to which it is comparatively easy of application, and as a vehicle for the application of other drugs, many of which may be combined with it, to the mucous membranes of those parts.

[Dr. Walter F. Chappell (*New York Medical Journal*, May 30, 1896) says, speaking of the use of zinc oleo-stearate in conjunction with other drugs, that the following combinations have, in his experience, proved most valuable: *Oleo-stearate of zinc with balsam of Peru*, in conditions requiring stimulation and healing; with liquor plumbi subacetatis, in acute rhinitis or the *coryza* accompanying a *common cold*; with boric and carbolic acids, in *copious watery nasal discharges* and *hyperæmic conditions*; with iodine, in *dry* and *atrophic rhinitis* and *ozæna*; with tannic acid, in *nosebleed*, and catarrhal conditions characterized by yellow discharges; with camphor and menthol, it is cooling, and therefore available in *hay fever* and *coryza*; with acetanilide, it is applied after operations as an *antiseptic* and *protective*; with antipyrine, as a hæmostatic in *recurring epistaxis*, and as a sedative in irritable conditions of the mucous membrane; with oleum pini pumilionis and eucalyptol, it is soothing and curative as an intratracheal injection, in *chronic bronchitis* and *asthmatic affections*; with oleum pini pumilionis, as a sedative in irritable conditions of the nasal mucous membrane characterized by *excessive sneezing*; and with orthochlorphenol, it is valuable in *syphilitic ulcerations* and *ozæna*.]

Zinc oxychloride.—When a solution of zinc chloride is added to the oxide a basic, insoluble compound, called the oxychloride, is formed, which soon dries and becomes very hard. It is used by dentists for temporary and sometimes for permanent fillings for the teeth.

The characteristics which recommend it for this purpose are that after it has hardened in the cavity in which it has been placed it neither expands nor contracts, that it is of about the same density as dentin, and that it retains its white colour. When the wet mixture of zinc oxide and chloride is to be introduced into a dental cavity care must be taken that the pulp is not exposed to its action, because in that case it acts immediately as a painful escharotic.

The hardness, firmness, and insolubility of this salt have also been made use of to some extent in the preparation of resistant *surgical dressings*. Zinc oxide mixed with one tenth as much zinc chloride and made into a paste with an equal weight of water has been recommended as an air-tight, firmly adherent and non-irritating dressing to be applied to *sutured wounds*, particularly when they are in situations which render them liable to infection from the bodily secretions. Thus, if applied after an operation for harelip the nasal secretions pass harmlessly over its surface, and the wound is effectually protected. After an operation for strangulated hernia also it may perhaps be of service. Such a dressing should be removed by the fifth or sixth day. It will very likely have become somewhat loosened by that time, but when it is still adherent it will need to be cut away with scissors.

[Dr. G. Betton Massey, of Philadelphia (*Journal of the American Medical Association*, August 24, 1895), finds nascent zinc oxychloride valuable as an adjuvant to the galvanic treatment of *hæmorrhagic endometritis* and *incipient malignant conditions of the uterus*. The positive electrode, made of zinc, is inserted into the uterine cavity, and the passage of the current leads to the formation of the oxychloride. Owing to the practical difficulty that has, he says, at times resulted from the adhesion of the electrode to the surface after a prolonged application, and also on account of the roughened surface rapidly attained by the electrode, he has been led to amalgamate the zinc freely with mercury before using it, and is convinced that the expedient is a valuable one. Not only does this keep the zinc surface always smooth, lubricated, and non-adhesive, says Dr. Massey, but a new value is attained in the use of a nascent oxychloride of mercury in addition to the oxychloride of zinc and a far more efficient alterative and antiseptic action results.]

Zinc permanganate occurs in crystals which closely resemble those of potassium permanganate. It is hygroscopic, soluble in water, and unites with organic substances and with alcohol to form explosive mixtures. This salt was recommended by the late Mr. Berkeley Hill as an injection in acute *gonorrhœa*. For this purpose it should be used alone, dissolved in distilled water, in the strength of 1 to 4,000, which is not irritating to the urethra.

[Dr. A. S. Hotaling, resident physician to the Bay View Hospital, Baltimore (*Medical News*, November 7, 1896), reports that zinc permanganate has proved more satisfactory in his hands than any other remedy in both acute and chronic cases of gonorrhœa. Its effect, he says, is discernible almost immediately, the discharge in the majority of cases becoming greatly reduced after a few injections. After the stage of acute inflammation has subsided, the injections are made four or five times a day, after urination, with an ordinary blunt-pointed hard-rubber syringe, with a capacity of from 3 to 4 drachms. His rule is to begin with a solution of half a grain to the ounce of water, gradually increasing it to a grain and a half. An alkaline diuretic is given, and the hygienic part of the treatment is followed closely in every case. The treatment is conducted under his personal supervision, instead of by the patient.

He reports fifty-eight cases, of which fifty were permanently cured. In thirty-three cases it was the first attack of gonorrhœa. The average duration of urethritis before the beginning of the treatment was about three weeks. The average time that elapsed between that of beginning the treatment and that of the cessation of the discharge was nine days. The cure was pronounced permanent in an average of twenty days after the treatment was begun.

Zinc phosphate is a white powder, insoluble in water, but soluble in acids, which is obtained by the interaction of zinc sulphate and an alkaline phosphate. It may occur as the diphosphate or triphosphate, the former of which is the more soluble. This salt was introduced by Mr. Barnes, of London, who thought it possessed special advantages for the treatment of certain forms of nervous diseases. *Epilepsy* attended with disorders of the uterine functions, and the nervous disorders which occur in enfeebled persons, especially in *exhaustion from over-excitement*, seemed much benefited by doses of from 2 to 5 grains, especially when combined with free phosphoric acid. In combination with quinine it was pronounced valuable in cases of *insanity during convalescence from fevers*. It has been tried with but little success in *locomotor ataxia* and *general paralysis*.

Zinc salicylate occurs in long, colourless, satiny, needlelike crystals, which have a sweet, somewhat bitter and styptic taste, are soluble in about twenty-five parts of cold water, freely in boiling water, and in three and a half parts of alcohol. This salt is used solely for topical applications as an *astringent* and *antiseptic* agent. It may be sprinkled over the surfaces of ulcerous and other *inflammatory cutaneous diseases*, may be insufflated into the nose in the treatment of *nasal catarrh*, and may be applied as a collyrium in *conjunctivitis* in solutions of from one half to one per cent. in strength, but it does not present any special advantages over other better-known preparations.

Zinc sozoiodolate.—This salt occurs in colourless, needlelike crystals, which are soluble in twenty parts of water and in alcohol. It has been used in solutions of from one half to one per cent. in strength in acute and chronic *blennorrhœa* and *gonorrhœa*, usually in combination with other drugs. In acute gonorrhœa the admixture of opium to the solution is fre-

quently advisable, while in chronic cases the salicylate of bismuth has been recommended as a useful combination. A stronger solution has been used as a mouth wash. It has also been used mixed with some inert powder to the strength of from 5 to 20 per cent. in catarrhal inflammation of the nasal and pharyngeal mucous membranes.

Zinc stearate compound.—This is the proprietary name of a light powder obtained by the combination of a soluble zinc salt with a mixture of stearic and other fatty acids. It is insoluble in water, slightly soluble in alcohol, and soluble in oil and turpentine. It may be used as a toilet powder, or as a protective in intertrigo, abrasions, and acute cutaneous diseases, but is intended principally as a vehicle for the local application of drugs used in the treatment of diseases of the cutaneous and mucous surfaces.

Zinc subgallate.—This is an odourless, non-toxic, non-irritating, greenish gray powder, of neutral reaction, insoluble in water or alcohol, containing 44 per cent. of zinc oxide and 56 per cent. of gallic acid. Internally it has been used in doses of from ½ to 4 grains in fermentative dyspepsia and in night sweats. Its chief use is externally as an antiseptic and desiccant dressing in the treatment of *eczema*, *fresh* and *septic wounds*, and *hæmorrhoids*, applied pure or diluted with inert powders, or in the form of an ointment. It has also been used in affections of the nasal mucous membrane, in *chronic purulent otitis media*, and in *gonorrhœa*. For the latter disease it is used suspended in the proportion of one to sixteen in mucilage and water as an injection.

Zinc sulphide.—This compound occurs in Nature as "blende," but as prepared for medical use is in the form of an impalpable powder. It was recommended by Duhring as a local application in subacute forms of *lupus erythematosus* and in *seborrhœa of the face*. For this purpose the following lotion, in which this salt is obtained by double decomposition, should be applied to the surface and the sediment allowed to adhere:

℞ Zinc sulphate, Potassium sulphide, each... ½ fl. dr.;
Rose water..... 3 fl. oz.;
Alcohol..... 3 to 6 fl. dr.
M.

Zinc sulphite.—This salt is obtained by the interaction of six parts of zinc sulphate and five and a quarter parts of sodium sulphite in solution, a reaction which takes place slowly, but is said to progress gradually to completion. It is not very soluble in water, but is soluble in excess of sulphurous acid, and is recommended as neither poisonous nor irritating. Tichborne says, in the *Medical Press and Circular* for October 12, 1892, that he introduced this salt many years ago as one especially adapted for *antiseptic* purposes. Any fabric can be impregnated with it without the use of any adhesive material by first boiling it in water to cleanse and sterilize it, then pouring over it a boiling solution of the above-named salts and allowing the whole to stand for twelve hours. The double decomposition leaves the sulphite entangled in a semisoluble condition in the meshes of the fabric. He claims that this salt exhibits not only the antiseptic properties of zinc chloride, but also the special action of the sulphites and combines with these the healing qualities of zinc oxide. He also states that this salt is sufficiently soluble to maintain a germicidal condition in any supernatant fluid, and ascribes this power to the slow absorption of oxygen by the sulphite and its consequent change into the more soluble sulphate. This property gives it, in his opinion, a peculiar advantage as a disinfectant for the stools of patients with typhoid fever and cholera.

Zinc sulphocarbolate, *zinci sulphocarbolas* (Br. Ph.), is described in the British Pharmacopœia as occurring in "colourless, transparent, tubular, efflorescent crystals, soluble in about twice their weight of rectified spirit or of water." The appearance of the crystals varies from colourless to reddish according to the process of manufacture. They are odourless, of acid or neutral reaction, and have a somewhat bitter and astringent taste.

During the past few years zinc sulphocarbolate has come to be considerably used in the treatment of *intestinal disorders*, particularly those of childhood, and appears to act both as an *astringent* and as an *intestinal antiseptic*. It is thus indicated in all cases in which the occurrence of fœtid stools with tympanites shows the presence of *fermentative processes in the gastro-intestinal tract*, and excellent results have been obtained from its use in *cholera infantum*, *cholera morbus*, and *typhoid fever*. As compared with the other sulphocarbolates, the zinc salt seems to have the better effect in these diseases, possibly on account of its astringent and nerve-tonic action. In cholera infantum it may be given in doses of from ¼ to 1 grain as often as necessary, usually every two hours, until the stools reassume their normal appearance and lose their offensive odour. As the symptoms pass away the intervals between the doses should be lengthened. In cholera morbus and diarrhœa of adults the usual dose is 2½ to 5 grains every two hours until the fermentative processes in the stomach and intestines are checked. The benefit is frequently quite marked and rapid, the temperature falls, vomiting, tympanites, and diarrhœa subside, and then the drug is to be given at longer intervals until stopped. When the first doses are rejected by the stomach they may be repeated every fifteen minutes until one is retained. When the lower bowel is involved in either children or adults enemas of from 5 to 40 grains of zinc sulphocarbolate to the pint of warm water may be of good effect. In the treatment of these diseases it may often be of advantage to combine with this drug others which are indicated in these conditions, such as bismuth or chalk. In *typhoid fever* this drug has done good service in controlling the diarrhœa, and it has been said to be able to abort attacks of this disease if given during the incipient stage in doses of 2 grains every three or four hours. Good results have also

been reported from its use in chronic intestinal catarrh and hæmatemesis. It is also said to have been of service in the *vomiting of pregnancy*, given in combination with small doses of calomel, and to have been beneficial in scarlet fever. On account of its unpleasant taste it is best administered in the form of tablets.

Externally, zinc sulphocarbolate has been used in solutions of from 1 to 5 per cent. as an antiseptic lotion, and as such is less apt to cause irritation than carbolic acid. The same lotion is useful in *balanitis*, and a solution from 0·5 to 2 per cent. in strength has been recommended for irrigation of the urethra in *gonorrhœa*. In *syphilitic* and *catarrhal laryngitis* and *pharyngitis* a spray of a 1-per-cent. solution has been used with some benefit. Similar solutions have also been employed as douches for *chronic purulent otitis media* and for *eczema of the external auditory canal*. This drug has also been used for *pityriasis capitis*.

Zinc sulphoichthyolate, or **ichthyol-sulphonate,** is a brownish-black, tarlike mass which was introduced into medicine together with the other compounds of sulphoichthyolic acid for the purpose of facilitating the use of ichthyol. The zinc salt is not so good as the other sulphoichthyolates for internal administration and is seldom used, but may be given in doses of from 4 to 15 grains in cases of *chronic rheumatism*, *chronic catarrhal diseases of the stomach* and *lungs*, *chronic catarrhal cystitis*, *chronic nephritis*, *chronic gonorrhœa*, and *diabetes*. Externally it may be used in the form of a liniment, incorporated in soap, or in the form of an ointment, 45 grains to the ounce, in cases of *acute* or *chronic rheumatism*, *neuralgia*, *sciatica*, *lumbago*, *intrapelvic inflammatory exudations*, *frostbites*, *burns*, *varicose veins*, *eczema*, *psoriasis*, *acne*, *erysipelas*, and *favus*.

Zinc sulphydrate.—This is a white, solid precipitate which decomposes on exposure to the air and must therefore be kept under water. It has been recommended for internal use in intestinal troubles dependent on bacterial infection in doses of from 0·5 to 2 grains, given preferably in pill form. Externally, it is useful in the treatment of *chronic eczema*, *psoriasis*, and *vegeto-parasitic skin diseases*, applied in a 10-per-cent. ointment with lanolin or lard.

Zinc tannate is a fine, nearly white powder, insoluble in water, alcohol, or ether, obtained by the interaction of zinc acetate and tannic acid. It has been used to a slight extent in *dyspepsia*, *phthisis*, and *diarrhœal affections* and rather more as a topical application to the mucous membranes.

Bonnewyn recommended in *conjunctivitis* with a muco-purulent discharge—

℞ Zinc tannate..... 30 grains;
Mucilage..... ½ fl. oz.;
Distilled water..... .. 6 oz.
M.

It has some effect as an *astringent* when applied to the nasal mucous membrane, and has been used as an injection in *gonorrhœa*. The dose internally is given as from 1½ to 4½ grains.

Zincohæmol is a dark-brown powder which contains about 1 per cent. of zinc in hæmol. It is slightly soluble in water and is a mild *astringent* and *tonic* in its action. It has been used in *anæmia*, *chlorosis*, and *diarrhœal affections* in doses of from 4 to 8 grains three times a day.

Zymoidin is a proprietary article which is said to be composed of the oxides of zinc, bismuth, and aluminum with iodine, boric, carbolic, gallic, and salicylic acids, quinine, and other drugs. It has been placed on the market for use as an *antiseptic* in the form of powder, ointment, solution, or bougie.

MATTHIAS LANCKTON FOSTER.

SUPPLEMENT.

Much has been added to our knowledge since the articles contained in the body of this work were prepared. Thus far, most of the literature of this additional knowledge has remained scattered through periodicals. Besides supplying accidental omissions, it is the function of this Supplement to give the substance of that literature, or at least of its more important portions, and it has been thought best to present it in many instances in almost the original authors' own words.

ABRASTOL
AIR

ABRASTOL.—See ASAPROL.

ABRIN.—See under JEQUIRITY (vol. i, page 562).

ACETONE.—This substance has recently acquired some fresh importance in medicine as a solvent of celluloid (*q. v.*, in Supplement).

ACETYLENE.—See under CALCIUM CARBIDE.

ACTOL.—See *Silver lactate*, under SILVER.

ADHÆSOL.—See under VARNISHES.

AIR, CONDENSED OR RAREFIED.—The use of the *pneumatic cabinet* is considered by Dr. Charles E. Quimby (*New York Medical Journal*, August 1, 1896) to be a specific and practically certain remedy for *pulmonary hæmorrhage*. The flow of blood, says Dr. Quimby, can be permanently arrested only by the formation of a clot, and the formation of a clot is determined by one or more of three causes: (*a*) Modification of the blood elements; (*b*) reduction of vascular tension with slowing of circulation; and (*c*) compression of the bleeding vessels. Upon the first of these the cabinet has no direct influence. For effecting the two others it is, *facile princeps*, our most powerful measure. To accomplish this we employ continuous respiration under negative differentiation with rarefactions of from a half to three quarters of an inch of mercury—differential respiration. In such conditions, a patient respires with the pulmonary circulation under existing barometric pressure, while the entire cutaneous expansion is relieved of from a quarter to half a pound of pressure to the square inch. The result is capillary dilatation with lowering of the systemic vascular tension, by which the venous system is filled to distention, while the pulmonary vessels suffer corresponding depletion and slowing of their circulation under lowered tension. Should the differentiation obtained by the cabinet alone not suffice, says Dr. Quimby, the use of compressed air for inhalation in connection with the cabinet must certainly cause compression of superficial bleeding vessels.

"With hæmorrhage thus arrested," he continues, "we have to consider secondly the prevention of its recurrence. For our present purposes the causes of pulmonary hæmorrhage may be condensed into two: Increased vascular tension and diminished nutrition of the vascular walls, resulting in weakening and diminished resistance. To fully appreciate the beauties of the cabinet action in diminishing tension and increasing nutrition, it is necessary to bear in mind that vascular tension serves solely the purpose of moving the blood through the vessels, for, if I mistake not, it is now generally admitted that nutritive interchange depends upon cellular action and not upon mechanical transudation. It is certainly well recognised that the vessels of an organ in functional activity are dilated, while vascular contraction marks those parts in which the circulation is relatively diminished. Tissue nutrition may therefore take place under lowered tension, provided the flow of blood is maintained. The evident indications in the condition under consideration, then, are to hasten pulmonary circulation as a means of augmenting tissue nutrition, without increased and, if possible, with decreased vascular tension. It is precisely this which is accomplished by the cabinet, by the motion termed force inspiration. When, after a few days', possibly a week's, treatment by differential respiration alone, we feel sure that the protective clots are firmly established, that motion is replaced by forced inspiration. At first, the rarefaction employed is but little more than has been used for differential respiration. But day by day it is increased until the maximum that is deemed advisable for the case in hand is reached. This may require anywhere from two to ten days. What now is the physics of this motion? During inspiration the condition is that just described for differential respiration, and the action that of a general cutaneous cupping. With the higher rarefaction the effect is greater, and at two inches of mercury, if the breath is held for two or three seconds after the lungs have reached full inflation, the capillary hyper-

æmia of the skin and the venous distention become very evident. At this point the breathing tube is dropped from the patient's mouth, as the controlling valve is closed, and the pulmonary pressure instantly drops to that upon the skin."

AIROL.—This is a German patented substitute for iodoform as an *antiseptic*, and is described as an iodine substitution compound of basic bismuth gallate (dermatol). Professor Coblentz gives the formula as

$$C_6H_2\begin{cases}-OH\\-OH\\-OH\\-COO.Bi\begin{cases}OH\\I\end{cases}\end{cases}.$$

This compound, he says, possesses the absorbent properties of subgallate of bismuth as well as the antiseptic properties of its iodine combination. It is a greenish-gray, fine, inodorous, and tasteless powder. Light produces no effect on it, while moist air causes it to turn red with loss of iodine. In contact with water, particularly when heated, the powder undergoes slow decomposition, becoming red with loss of iodine. Dilute alkalies and acids dissolve it readily.

Haegler (*Beiträge zur klinische Chirurgie*, xv, 1; *Centralblatt für Chirurgie*, January 18, 1896) has made comparative trials of airol, dermatol, and iodoform, and has satisfied himself that airol is less poisonous than iodoform. Moreover, he says, it is free from odour and does not irritate the sound skin. Two points of its superiority to iodoform are its property of parting with a portion of its iodine in the presence of the warm fluids of the body and the fact that, by reason of the bismuth contained in it, it is in a high degree *desiccative*. It is applied for the most part with a powder blower; it is used also in the form of a 10- or 20-per-cent. gauze, in that of a 10-per-cent. solution in collodion, and, for *tuberculous affections*, in that of a 10-per-cent. emulsion in a mixture of equal parts of glycerin and water. In the course of a year Haegler has used airol in about two thousand cases, and has observed its decided effect on the tuberculous process, but no untoward action. He regards it as a useful substitute for iodoform.

De Sanctis, of Rome (*Gazzetta degli ospedali*, November 1, 1896; *British Medical Journal*, December 26, 1896), reports having used airol with results which he characterizes as brilliant in *intertrigo*, both of the secreting and of the pruriginous type. Dusted over the affected parts, he says, it gives immediate relief, soothing pain, subduing itching, and healing excoriations. He gives as examples of its use two very severe cases. One of these was that of an old woman who had intertrigo of the whole hypogastric region, both groins, one thigh, and part of the external genitals; the whole surface was reddened, raised, and partially covered with a greasy, grayish layer, and in some places eroded to such an extent that the slightest touch caused bleeding. Local treatment of various kinds had been tried in vain. The application of airol at once got rid of the burning feeling, which was replaced by an agreeable sense of freshness, and sleep ceased to be interrupted by the pain and itching. The powder was applied daily and kept on with a bandage. In four days the eroded surface was completely healed; a few days later the cure was complete, and there had been no complaint of recurrence four months after treatment. De Sanctis recommends airol as one of the best remedies for intertrigo; it is non-toxic, and its use is not attended with any drawbacks.

AKTOL.—See *Silver lactate*, under SILVER.

ALBOLENE.—This is an American proprietary refined product of petroleum which is employed as a base for ointments and as a *lubricant*. It is odourless and does not become rancid.

Liquid Albolene, which is very readily diffused in the form of spray, is a suitable solvent for drugs that it is desired to apply to the nasopharyngeal passages.

ALLYL SULPHOCARBAMIDE, ALLYL SULPHOUREA, ALLYL THIOUREA.—See THIOSINAMINE.

ALLYL TRIBROMIDE, $C_3H_5Br_3$, is described by Professor Coblentz as a colourless or slightly yellowish liquid which has been recommended as a *sedative* and *anodyne* to be given subcutaneously in doses of from 2 to 4 drops, dissolved in ether, in *hysteria*, *asthma*, *whooping-cough*, etc.

ALUMINUM BOROTANNICOTARTRATE.—This is made by dissolving aluminum borotannate in a solution of tartaric acid. It is called also *cutal*. It is *astringent* and *antiseptic*, and is employed topically, pure or attenuated, in *catarrhal states of the skin* or *mucous membranes* attended with supersecretion. Cf. TANNAL.

AMBER.—Dr. William Murrell, of London (*Clinical Sketches*, February, 1896), says that for some years he has used oil of amber, both internally and externally, in the treatment of *whooping-cough*. He has not kept notes of his cases, but the results have been so satisfactory that the custom of giving it has degenerated into a routine. He has found it useful also in *chronic bronchitis* and *winter cough*. In whooping-cough he generally orders a teaspoonful to be rubbed in along the course of the spine, night and morning, before the fire. For *rheumatism* he finds it better to have it made into a liniment with equal parts of aromatic spirit of ammonia and spirit of camphor. For internal administration, from 3 to 10 drops may be taken every four hours, on a piece of sugar or on a crumb of bread, but this mode of administration presents some difficulty in the case of children. The following mixture, Dr. Murrell thinks, is preferable:

℞ Oil of amber.....	10 minims;
Powdered gum acacia...	1 drachm;
Syrup of orange flowers.	2 drachms;
Oil of anise.....	3 minims;
Water, to.....	1 oz.

M.

The difficulty is, he says, in covering the somewhat disagreeable taste of the amber oil. He has made some experiments with the view

of obtaining a tasteless amber oil, but the results have been unsatisfactory. He gives the following formula for a liniment:

℞ Oil of amber..... 6 drachms;
Oil of rosemary, } each ... 1 drachm;
Oil of origanum, }
Oil of turpentine..... 1 oz.;
Linseed oil, to..... 4 oz.
M.

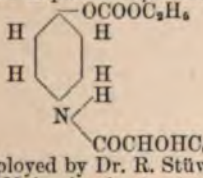
Dr. Murrell is satisfied that more extensive trials will show that oil of amber is a useful therapeutic agent.

AMMONIUM CHLORIDE, in drachm doses, has been used successfully in one case of *delirium tremens* by Dr. Gilbert G. Cottam (*Medicine*, November, 1896; *New York Medical Journal*, November 21, 1896). Having some knowledge of the patient and his tolerance of drugs, Dr. Cottam began by administering a grain of morphine hypodermically. This was without the slightest effect. Several hours after the administration of the morphine, and after the symptoms had all become aggravated, he gave a drachm of chloride of ammonium. This was promptly vomited. After a short time another was given, which was retained. It acted quickly and favourably. In fifteen minutes the hallucinations of snakes and lizards had disappeared, and the patient had become quite rational. In forty minutes he was asleep, and it was not thought necessary to continue the administration of the drug.

Dr. W. Bourne Gossett, of Independence, Missouri (*New York Medical Journal*, January 23, 1897), reports the case of a lewd woman who had been "on a drunk" for eight days, and just before he saw her had had the usual "reptile hallucinations." He found her very restless, moving incessantly, and she had to be forced to stay in bed. At once he sent to a neighbouring apothecary's for a drachm of chloride of ammonium, but before it was brought she was beginning to get more excited and seeing "snakes." As soon as he got the ammonium he at once gave her half a drachm in a large quantity of water—four ounces—and had her drink it in one or two gulps. In fifteen minutes she was quieter, and in fifteen minutes more he gave her the other half drachm. In a short time she was asleep and slept for six hours. She awoke feeling much better, and had no more trouble. Dr. Gossett says he would not hesitate to give a drachm and repeat the dose in half an hour if the patient was not better.

AMMONOL. — Ammoniated phenylacetamide (see under PHENYLACETAMIDE).

AMYGDOPHENINE. — This substitution derivative of paramidophenol,



has been employed by Dr. R. Stüve, of Frankfort on the Main, in the treatment of *rheumatism* (*Centralblatt für innere Medicin*, November 16, 1895), and found to be very serviceable. One of the twenty rheumatic patients to whom he gave it was suffering severely from *aortic insufficiency*, and this patient was cured of his rheumatism in a few days. In only one of the twenty cases did the remedy prove of no benefit. Dr. Stüve found it useful also in *neuralgia*. He gave it in 15 grains from once to six times a day, in the form of Engel's compressed tablets or in powder, and observed no unpleasant effects, except in the case of a woman who, while taking 75 grains a day, complained of slight dizziness on the second day.

AMYL NITRITE.—M. Hayem (*Journal des praticiens*, 1895; *Medical Record*, January 18, 1896) says this drug can be given in much larger doses than is usually believed, for he has more than once given from 50 to 100 drops to be inhaled at once, without meeting with any dangerous symptoms. The following is his method of employing the remedy in *pneumonia* (*Medical Press*): 15 drops were poured on a compress and inhaled in the recumbent posture without effort; a few seconds afterward the same dose was renewed, and yet 15 drops more were given, so that in the space of five minutes about 50 drops were inhaled. Redness of the face, acceleration of the pulse, and precipitation of the respiratory movements followed. These phenomena soon gave place to a slight cough, a thready pulse, dyspnœa, lividity of the face, and cyanosis of the extremities and of the lips. In ordinary cases only one series of inhalations was given daily, while two (morning and evening) were ordered where the symptoms were grave. It did not appear to M. Hayem that the treatment had any marked effect on the duration of the disease, or on the thermic cycle; the effects seemed to be entirely local, consisting in decrease of the dyspnœa, modification of the expectoration, and attenuation of the stethoscopic signs. The drug did not destroy the virulence of the pneumococci; its chief influence was on the pulmonary circulation, producing a strong flux which facilitated the return of the blood into the alveoli and hastening the absorption of the exudation. In a period of two years he had treated seventy-seven cases of pneumonia, with sixteen deaths, by inhalations of the nitrite. Several of the fatal cases had occurred in hard drinkers.

AMYLOFORM.—According to the *Wiener medizinische Blätter* for September 3, 1896, this is a chemical compound of formaldehyde and starch, made by a patented process devised by Professor A. Classen. On its coming in contact with living tissue or with the secretions, formaldehyde is set free. It is thought to be an excellent *antiseptic* and *deodorizer* for *wounds*, far more energetic than iodoform, odourless, unirritating, and harmless.

ANÆSTHETICS.—Dr. F. Hewitt and Mr. A. M. Sheild (*British Medical Journal*, October 26, 1896) have called attention to the importance of the patient's posture during general anæsthesia. They think that, so far as may

be practicable, the head should be kept in a line with the long axis of the body and the face turned to one side when the patient is in the supine posture; that the lateral posture is of advantage in most major operations within or about the mouth and nose; and that, provided there is no special contra-indication, the patient should be turned upon his side at once when the operation is finished.

The Laborde method of resuscitation by *rhythmical tractions on the tongue* has been made the subject of laboratory experiment by Dr. H. A. Haubold, of Bellevue Hospital Medical College (*New York Medical Journal*, January 23, 1897). His observations have led him to conclude that the Laborde method leaves much to be desired, and he thinks it should not be employed to the exclusion of the other methods now in use.

ANÆSTILE.—This name has been given to a mixture of ethyl chloride and methyl chloride. It is employed as a *local anæsthetic*. It does not render the skin so hard as methyl chloride alone does. (Dr. W. C. Daish, *Australian Medical Journal*, December 20, 1895.)

ANETHOL, or *anise camphor*, a camphor-like constituent of oil of anise, has been employed to some extent as an *antiseptic*.

ANHALONIUM LEWINII.—In a paper read before the Association of American Physicians in May, 1896 (*Medical Record*, August 22, 1896), Dr. D. W. Prentiss and Dr. Francis P. Morgan, of Washington, gave an account of their investigation of the medicinal properties of *mescal*, or *muscale buttons*, which they find to "possess properties which are remarkable, the exact likeness of which is not found in any other known drug, and also that it possesses virtues which, when applied in the treatment of certain diseased conditions, may prove the drug a valuable addition to our present list of therapeutic agents."

Prentiss and Morgan experimented on eight young men, and found that the most remarkable visions were the result, the beauty and variety of which were much enhanced by drumming or otherwise marking regular time, after the manner of the Indians. One of the young men described his experience as follows:

"The first sensations that followed my taking the drug came upon thoughtlessly closing my eyes. Instantly there sprang into the field of view a host of little tubes of shining light, down which green and red balls the size of peas were constantly rolling. The tubes of light bent themselves into the shape of letters, but they would spell nothing, and slowly curving themselves into grotesque shapes, began to revolve rapidly, the green and red balls going in the opposite direction with even greater velocity. All the field of view between these silent wheels was filled in with a shifting mass of green. The colours were wonderful. They were the colours of the spectrum intensified as though bathed in the fiercest sunlight. No words can give an idea of their intensity or of their ceaseless persistent motion. The figures constantly changed in form and colour, but always remained a series of fantastic curves, revolving rapidly back and forth upon their own axis. The forms changed through rich arabesques, Syrian-carpet patterns, and plain geometric figures, and with each new form came a new flush of colour, every shade appearing, from pure white to deepest purple. When the eyes opened and the light was turned up, the visions faded like stars going out in daylight, and the room, tables, chairs, and all surroundings came back into real existence and within reach of the hands."

In some cases no effect whatever was produced upon the reason or will of the individual. In others there were some slowness of thought and loss of power of expression, and in one of the experiments there was a marked delusion. Dilatation of the pupil was well marked in every case, and persisted for from twelve to twenty-four hours after the drug was taken. The dilatation was accompanied by a slight loss of the power of accommodation and consequent disturbance of vision. More or less depression of the muscular system existed in every case, and this was the first effect noticed after the drug was taken. It ranged from a feeling of lazy contentment to decided muscular depression. Partial anæsthesia of the skin was present in three of the cases, appearing when the effects of the drug began to wear off. The heart's action was at first rendered slower and stronger. This was followed by a rise to the normal which continued during the period of greatest activity of the drug. In the cases in which the muscular depression was greatest, slight, if any, depression of the heart was present. The respiration was unaffected in all cases but one. In this it seemed to partake slightly of the general muscular depression. Upon the stomach the drug produced an effect which varied from a feeling of uneasiness and fulness at intervals to nausea and vomiting. Inability to sleep for at least twelve hours after the influence of the drug passed off was a uniform effect. Appreciation of the duration of time was lost in all cases—as in the effect of cannabis indica. In one case a snowstorm appeared to last an hour, although in fact the vision continued not more than a minute. There was no constant effect upon the bowels, skin, temperature, or any secretion.

Prentiss and Morgan think that the conditions in which it seems probable that the use of mescal buttons will produce beneficial results are the following: *General "nervousness," nervous headache, nervous irritative cough, colic, hysterical manifestations*, and other similar affections in which an *antispasmodic* is indicated; that they will be found useful as a cerebral stimulant in *neurasthenia* and in depressed conditions of the mind—*hypochondriasis, melancholia*, and allied conditions—as a substitute for opium and chloral in conditions of great *nervous irritability* or *restlessness*, in active *delirium* and *mania*, and in *insomnia caused by pain*. In the last condition, they remark, it acts to produce sleep, not as a hypnotic, but by relieving the cause of the insomnia. In full physiological doses

it produces insomnia, but in therapeutic doses it does not have this effect.

Prentiss and Morgan give the dose of anhalonium in substance as from 7 to 15 grains; that of a 10-per-cent. tincture as from 1 to 2 teaspoonfuls: and that of a fluid extract as from 7 to 15 drops.

Dr. D. A. Richardson, of Denver (*New York Medical Journal*, August 8, 1896), reports a case of *occipital* and *frontal cephalalgia* in which the attacks were kept in abeyance by nightly doses of 4 drops of the tincture. In that case these small doses seemed to Dr. Richardson to have a decided *diuretic* action, and he suggests that anhalonium may act as a solvent of uric acid.

One of the alkaloids of anhalonium, *anhalonine*, has been recommended as a *cardiac* and *respiratory stimulant* in the treatment of *angina pectoris* and *asthma*, but clinical data are thus far insufficient to warrant its use in practice. Not even the dose is stated in the few publications accessible in which it is mentioned.

ANHYDROGLUCOCHLORAL. — See CHLORALOSE.

ANTINOSINE.—This is a compound of sodium and nosophene, used for the same purposes as nosophene.

ANTIPYRINE MANDELATE, ANTIPYRINE PHENYLGLYCOLATE.—See TUSSOL.

ANTIPYRINE SALICYLATE. — See SALIPYRINE.

ANTISTREPTOCOCCIC SERUM, ANTISTREPTOCOCCIN, ANTISTREPTOCOCCUS SERUM. — See under SERUM TREATMENT (vol. ii, page 178).

ANTIVENENE. — See under SERUM TREATMENT (vol. ii, page 188).

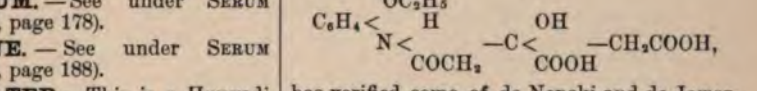
APENTA WATER.—This is a Hunyadi water, formerly known as Rákóczy water, that has recently appeared on the market. It is particularly rich in magnesium sulphate, and is a valuable *purgative*.

APOLYSINE.—De Nencki and de Jaworski (*Presse médicale*, October 26, 1895; *New York Medical Journal*, November 30, 1895) describe this as a yellowish-white crystalline powder of a sour taste, less acid than citric acid, and of a specific odour. It is soluble in cold water in the proportion of one in twenty-five, and quite soluble in boiling water. It melts at a temperature of 161·3° F. It is easily dissolved both in alcohol and in cold glycerin. In its origin apolysine may be compared to phenacetine. Both compounds spring from paraphenetidine, and there is no difference between them, except that an atom of hydrogen in phenacetine, in the amide group (NH_2), is replaced by the element of acetic acid, while in apolysine the same atom of hydrogen is replaced by the citric-acid nucleus. On comparing the chemical formulas of these combinations, their origin, their formation, and their difference may be more readily understood. They show that apolysine is very closely allied to phenacetine.

Apolysine, according to the authors, possesses remarkable *antipyretic* and *analgetic* properties. They administered the drug both as an antipyretic and analgetic and as an antipyretic only. They employed it in many cases, and in the febrile affections a lowering of the temperature of from one to two degrees was observed, which was maintained for three or four hours at a time. In painful affections, such as *neuralgia*, etc., the pain disappeared rapidly after the administration of a few doses, which varied from 8 to 45 grains once a day. The authors state that in many of these cases other analgetics had been used previously without success.

Their clinical observations have led them to the following conclusions: 1. Apolysine administered to fever patients lowers the temperature and at the same time prevents a series of coexisting symptoms, particularly pain. 2. Given to patients suffering from neuralgia, etc., it diminishes the violence of the pain, allays hyperæsthesia, shortens the duration of the attack, and often completely suppresses the symptoms. 3. Owing to its chemical properties, it acts promptly and regularly, and exercises no injurious effect on the organism. Its employment is contra-indicated during fasting and when there are excessive acid secretions in the stomach. 4. Finally, apolysine is more soluble than other drugs in the same group, and consequently more promptly and more easily absorbed.

Dr. David Cerna, of Galveston (*Journal of the American Medical Association*, June 20, 1896), who gives the following formula of apolysine:



has verified some of de Nencki and de Jaworski's statements in experiments on animals, and has found apolysine a prompt and efficient remedy in a case of *lumbago*, and in one of *muscular rheumatism*. The dose for an adult is from 15 to 30 grains. Although apolysine has been said not to be poisonous, Dr. Cerna has known it to kill an animal, and he gives a warning against its routine and indiscriminate employment.

APOMORPHINE.—Mr. Edward Balm, of Hyderabad (*Indian Medical Record*, July 1, 1895), has found apomorphine of great value as an *antispasmodic*. He says that in the Afzulgunj Hospital, Hyderabad, Dr. Lawrie used it in the treatment of *tetanus* on the suggestion of Dr. Bomford, of Calcutta, in doses of from $\frac{1}{10}$ to $\frac{1}{4}$ of a grain hypodermically twice or three times a day, and the results were not disappointing. When, in 1894, Mr. Balm took charge of the hospital, he had a unique and distressing case of *hiccough* in a man fifty years old. He had suffered from it for about six months, and the acts numbered from 30 to 40 a minute. He had been a well-built man, but was reduced to a skeleton, and the sight of food was most loathsome to him. He had tried a lot of native medicines without any re-

lief, and Mr. Balm's predecessor had prescribed for him almost all the drugs of the pharmacopœia without the slightest good. Mr. Balm subsequently tried atropine, morphine by the mouth and subcutaneously, bromide of potassium, camphor, chloroform, emetics, a mustard plaster over the region of the diaphragm, and a host of other measures without the least good. He then gave him ¼ of a grain of apomorphine dissolved in 107 parts of water hypodermically. In less than three minutes the symptom subsided, and in five minutes more he vomited. He was not troubled with the symptom for two days, but on the third day he came again to the hospital with it, but it was less troublesome than before. Mr. Balm gave him ¼ of a grain of apomorphine more, hypodermically. The symptom subsided in about the same time as before and there were retching and vomiting for the whole day, but the hiccough never recurred. Mr. Balm has also tried apomorphine in a very bad case of *hysteria*, in a young woman, that had defied every other treatment, also in cases of *asthma*, and in all these instances it afforded temporary relief.

ARACHIS HYPOGÆA.—Dr. Heinrich Stern (*Food and Sanitation*, August 17, 1895; *New York Medical Journal*, September 14, 1895) has employed peanut meal as the chief constituent of a bread for persons with *diabetes*. Peanut meal, he says, is the residue left after the oil has been expressed. He has devised the following method for preparing peanut flour in the household: The peanut kernels, including their inner coating, which is also nutritious and not very rich in carbohydrates, are put into a tin kettle in which small holes have been previously made. This is kept uncovered and placed on or in a pan filled with water, and this has to be kept boiling for about half an hour to allow of partial extraction of the superfluous oil. After the kernels have been dried they are pounded into fine particles with the aid of a rolling pin. The pounded or bruised kernels are then placed in boiling water acidulated to some degree with tartaric acid or vinegar, preferably with the latter. The boiling in the acidulated water has to be continued for some time for different reasons: For the extraction of saccharine elements, which occur to some amount in nuts of American growth; to overcome the smell and taste characteristic of the peanut; and to prevent emulsification of the remaining oil, which, to some degree, is essential to a rational diabetic food, as fats must supply the deficiency of the carbohydrate elements. It is true, says Dr. Stern, that a partial emulsification of the oil might relieve the pancreatic juice of some work, and this might be especially beneficial in grave cases of diabetes mellitus in which the pancreas seems to be involved, but he leaves it to future investigation to determine whether the oil in peanut flour shall be introduced in its natural state into the alimentary tract or in the form of a partial or complete emulsion.

Having undergone a thorough boiling with acidulated water, the ground kernels are subjected to dry heat, to effect complete evaporation of that fluid; but great care must be exercised, says Dr. Stern, that they do not become browned or roasted. An additional treatment with the rolling pin, he says, will produce nearly as fine a flour as the common wheat flour of commerce. From 30 to 40 per cent. of the oil, he says, is necessary for a complete and rational diabetic food. More hydrocarbons are not required and would interfere with digestion. It is not possible to control the amount of oil expressed by the domestic process and to determine its percentage with any degree of certainty; if the flour is manufactured in mills, however, this could be readily controlled and ascertained.

Dr. Stern has made use of the flour in different ways, the simplest of which is that of giving it in the form of a porridge, some milk being added to it. Bread and biscuits can also be made from it, but the most agreeable and most easily digestible form in which to use it is, he thinks, the German pancake. He has used this flour with four diabetics, and a number of other patients. In the non-diabetic cases, mostly tuberculous in character, he obtained satisfactory results, inasmuch as digestion was not to any extent taxed, and in some cases the weight of the patient did not decrease, while in one instance there was actual gain in weight noticed. With the first diabetic patient to whom he recommended the flour its use was a complete failure at first, as the digestion became very much impaired, thereby aggravating the general condition of the patient, an old man. A more careful and rational preparation of the flour, however, and the employment of smaller quantities when starting with it, increased its digestibility, and at the time of Dr. Stern's writing this patient enjoyed, as far as circumstances permitted, a comfortable state of health. The three other patients were also thriving well on this flour, the German pancake being the usual form in which they employed it. In conjunction with eatables made of this flour, Dr. Stern allowed those patients only such food stuffs as are generally recognised as permissible in diabetes mellitus. He has done this, he says, not because he is a believer in the complete exclusion of carbohydrates in diabetes (for he says that fats and even nitrogenous substances are capable of producing glycogen), but to investigate the intrinsic value of peanut flour as a food, and its ability to reduce the glycogenic sugar of the urine.

ARGONIN.—See under SILVER (vol. ii, page 197).

ASBESTOS.—A Moscow surgeon, Dr. Volintzeff (*Gazette des hôpitaux; Union médicale*, July 18, 1896), remarks that the density of this material is much greater than that of cotton or of tarlatan; it is less porous than either of them and less hygroscopic. The escape of vapours takes place more slowly under a dressing of asbestos than under any other. It is not so good a conductor of heat as cotton is, but on this point, says the writer,

the results of the investigation are not yet perfectly satisfactory. Asbestos, he says, absorbs the albuminoid secretions better than absorbent cotton or tarlatan does. In regard to clinical observations, Dr. Volintzeff thinks they are yet too small in number to enable him to give a definitive judgment. Asbestos is not expensive, he remarks, because it may be used several times.

Dr. E. O'N. Kane, of Kane, Pennsylvania (*Medical Record*, February 18, 1896), recommends asbestos as a useful substance for surgical dressings. These dressings, he says, may be handled by dirty hands or spattered with blood or any sort of filth, and yet can be rendered absolutely aseptic in less than two minutes by tossing them upon the coals or into the blaze of an ordinary kitchen stove. However, repeated burnings, he says, seem to injure the quality of the material somewhat. The form of asbestos most used is the asbestos fibre; it is as soft as silk floss, and its absorbent qualities are greater than those of absorbent cotton. Asbestos wicking, packing, and cording are adapted for drainage tubes.

ATROPINE.—Aubert (*Lyon médical*, January 3, 1897; *New York Medical Journal*, January 23, 1897) calls attention to the efficiency of atropine in the correction of several inconveniences caused by quinine. Among the symptoms which are produced by the administration of quinine, even in doses of from 6 to 8 grains, the most frequent are buzzing and ringing in the ears, a sound like that of rushing water, deafness, vertigo, and headache. In certain cases these symptoms are rather accentuated, and the patients refuse to continue the use of the quinine.

M. Aubert relates the histories of three cases of neuralgia in which he was able to attenuate to a very great degree, and even to suppress, these disagreeable symptoms by the addition of a small dose of atropine sulphate. From 5 to 7 grains of quinine were given at a time, and to each dose the author added 0·007 of a grain of atropine sulphate. In one case this prevented the disagreeable symptoms, and in the two others greatly moderated them. The periodical pains were allayed, and no appreciable symptom of atropinism was experienced. He states that he has not had occasion to use larger doses of quinine, and does not know what the results would be with larger quantities. He is not aware that atropine has before been employed for the purpose of mitigating the disagreeable symptoms provoked by quinine.

BATHS.—Under this heading it is proper to class what is known as the Schott treatment of *diseases of the heart* practised at the baths of Nauheim, at the foot of the eastern end of the Taunus range of mountains. An excellent account of the place and of the treatment has been given by Dr. William C. Rives, lecturer on diseases of the chest and on general medicine in the New York Polyclinic (*New York Medical Journal*, April 11, 1896). The hotels, says Dr. Rives, furnish good accommodation, and are most of them provided with lifts, a matter of much importance for heart patients. They are apt to be very full in the height of the season, and it is almost impossible to obtain rooms at the Kaiserhof in particular, which at the time of Dr. Rives's writing was being altered and enlarged, without securing them weeks or even months beforehand. The villas, which are very numerous and usually stand in the midst of small grounds, are large, spacious, and well managed; the food and cooking are essentially German in character. Arrangements should be made beforehand as to whether board is to be provided or not, as many will prefer to take one at least of their meals at one of the hotels. Rolling chairs are to be hired by the week at reasonable prices, as well as attendants to push them.

All ordinary articles likely to be needed can be obtained in the town; others can be quickly sent from Frankfort. The summer climate of Nauheim, like that of the other Taunus resorts, is somewhat changeable, often cold and rainy, but seldom oppressively hot. The soil is good, and the position of the town favourable for health.

The place is furnished with a water supply and a system of drainage said to be good, but the sanitary conditions are probably susceptible of some further improvement. Although the surrounding country is less attractive than at many other resorts, there are walks, drives, and excursions of much interest for those who are able to undertake them. The Kurhaus is large and handsome, and furnishes the usual means of recreation. Subscriptions have been already taken for an English church, and a piece of land secured upon which one will probably soon be built. The regular season at Nauheim lasts from the 1st of May to the end of September, but the bath houses are open also in April and October.

The following table, showing the composition of the waters, is taken from Eulenburg's *Real-Encyclopädie der gesammten Heilkunde:*

	Friedrich Wilhelmsquelle.	Grosser Sprudel.	Curbrunnen.	Carlsbrunnen.
	Parts in 1,000.	Parts in 1,000.	Parts in 1,000.	Parts in 1,000.
Sodium chloride	29·294	21·824	15·421	9·860
Potassium chloride	1·119	0·497	0·527	0·072
Calcium chloride	3·324	1·700	1·034	1·057
Magnesium chloride	0·525	0·440	0·738	0·204
Calcium sulphate	0·035	0·034	0·023	0·227
Calcium carbonate	2·601	2·354	1·146	0·951
Iron carbonate	0·048	0·038	0·026	0·014
Total solids	35·357	26·353	18·682	12·119
Carbonic acid (in cubic centimetres)	578·93	712·65	995·22	720·93
Temperature	95·5° F.	88·8° F.	70·5° F.	59° F.

In the midst of the park, near the banks of the little river Ursa, says Dr. Rives, burst forth the springs that supply the bath houses on which the fame of Nauheim depends. These come from a great depth (five hundred and twenty-three and five hundred and ninety feet), and were found by means of borings made at different times in the course of this century. The two now in use—No. 7, the Grosser Sprudel, and No. 12, the Friedrich Wilhelmsquelle (the figures being used to designate the number of the boring)—spout forth as white foaming liquids, only thirty-two feet apart, high above the surface of the ground, and are connected with five bath houses, four in the immediate neighbourhood, and a fifth (bath house No. 4) which provides only simple saline baths from spring No. 7 outside the park at a little distance from the others.

At the present time there are in the whole establishment at Nauheim a hundred and ninety-six bathrooms with two hundred and four tubs. The tubs are of wood, painted, which has been found to be the most satisfactory material, and are of large size, so that when a tub is filled the body of the bather is entirely immersed up to the neck, and the pressure of the water on its surface is very considerable. Everything connected with the baths, which are under government control, is admirably systematized, and the attendants are well fitted by long experience for the discharge of their duties.

Drinking the waters, says Dr. Rives, plays but a secondary part at Nauheim, but their internal use is of some value in gouty conditions and disorders of the liver, and the Curbrunnen water, diluted, is said to resemble that of the Ragoczy spring of Kissingen, and the Carlsbrunnen, the Elizabeth-Brunnen of Homburg. The Ludwigsbrunnen is also used as a table water. The Schwalheim spring, two miles distant, yields a ferruginous water containing carbonic acid.

The first bath house at Nauheim, according to Dr. Rives, was opened in 1835, and the baths have been used for many years with advantage in *gout*, *rheumatism*, *rickets*, and so-called *scrofulous diseases*, and have acquired a well-merited repute in the treatment of *locomotor ataxia* and other diseases of the spinal cord. Professor F. W. Beneke, of Marburg, was the first to show, contrary to the views then prevailing, not only that patients with heart disease, more especially those recovering from acute rheumatism, could bear balneological treatment, but that they were actually benefited by such a course. Beneke, who was physician to the Nauheim baths from 1857 to 1866, and continued to visit them up to his death, in 1883, wrote several articles upon the effects he had observed there, the earliest of which appeared in 1859. After the publication of his more important work, *Zur Therapie des Gelenkrheumatismus und der ihm verbundenen Herzkrankheiten*, in 1872, patients with heart disease began to frequent Nauheim in greater numbers, and, on the lines of investigation suggested by his observations, the baths began to be studied more closely by other physicians.

In 1880 Dr. August Schott, who had been making independent studies since 1871, published a paper (*Berliner klinische Wochenschrift*, 1880, No. 20) by far the most important and exhaustive of any that had yet appeared, and the first to do full justice to the remarkable effect of the baths upon the heart. Numerous articles relating to the same and allied subjects have since been written by himself and his brother, Dr. Theodor Schott, and to their joint labours the present celebrity of Nauheim is largely due.

Within the last ten years the annual number of visitors during the season, a large proportion of whom are heart patients, has more than doubled, amounting to over twelve thousand in 1895.

The foregoing is substantially in Dr. Rives's own words. He describes the effect of the baths as that of regulating the action and strengthening and improving the nutrition of the diseased heart, whether its inability to perform its functions properly depends upon valvular lesions and their consequences or upon malnutrition or disease of the cardiac muscular substance. These results, he says, are chiefly due to the chloride of sodium, to the more irritating chloride of calcium, and to the free carbonic acid which these waters are said to contain in larger amount than almost any other baths in Germany. They contain, moreover, a considerable percentage of iron, to which may also be attributed a tonic influence. The most powerful though more temporary stimulation, as proved experimentally, is caused by the carbonic acid. By means of the action of these saline and gaseous contents of the bath upon the terminal branches of the sensory nerves of the skin an impression is made upon the cardiac and vaso-motor centres by which the heart is stimulated in a reflex way to more powerful and vigorous contraction and the arteries are more completely filled, and at the same time the cutaneous vessels dilate, peripheral resistance is lessened, and the whole circulation is rendered freer and more active, while metabolism is promoted and a marked influence exerted upon the trophic centres, as must be inferred from the striking evidences of improvement in the bodily nutrition in general, and in that of the heart in particular, and the persistence and even increase of the good effects long after the patient has completed the course.

The immediate objective results of the baths are stated by Dr. Rives as follows: "Examination of the pulse, confirmed by sphygmographic tracings and the sphygmomanometer, shows it to be made slower, stronger, and of increased volume, the cardiac sounds become more distinct, and in cases of dilatation an unmistakable contraction of the heart, demonstrable by percussion and by the change in the position of the apex beat, is observed. This contraction is most noticeable in the transverse diameter of the heart, and takes place to little or no extent when the enlargement is solely compensatory, as in many cases of organic

mitral and aortic regurgitation. Dr. Bezly Thorne, however, affirms that there is a diminution in the area of cardiac dulness, as measured in the oblique transverse diameter, of a third to about half an inch even in the healthy heart. The respiration becomes easy, and is slower and deeper, and there is usually increased action of the kidneys. Subjectively, a sense of weight and oppression on the chest, greater than in an ordinary bath, is at first experienced, which quickly passes off; the skin soon becomes warm, and tingling, accompanied with redness, is felt in its more sensitive parts. Afterward, the patient feels invigorated, and is generally conscious of a sense of drowsiness."

Dr. Robert H. Babcock, of Chicago, in a paper read before the Mississippi Valley Medical Association (*Journal of the American Medical Association*, November 11, 1893), says that during the baths there is a slowing of the pulse with increased volume and strength, and irregularity, if any exists, is lessened or disappears. The cardiac contractions are increased in vigour and the cavities better emptied, thus permitting of a diminution in the size of a dilated heart. This marked and beneficial effect on the action of the heart does not appear at once, but persists for a considerable time subsequent to the baths. If properly administered, says Dr. Babcock, the baths occasion a gradual and perceptible amelioration of the symptoms. During the gymnastics the rate of the pulse falls and the volume and strength are increased.

While Oertel's method is limited to cases of heart disease in which compensation has not been lost, the Schott method, says Dr. Babcock, is applicable to a greater variety of cases, and, as the treatment can be carried out in this country by artificially prepared baths and the gymnastics, it seems that by careful selection patients subjected to this treatment may be greatly benefited.

In a subsequent communication, read before the American Climatological Association (*New York Medical Journal*, December 8, 1894), Dr. Babcock says that the baths owe their efficacy chiefly to free carbonic acid, sodium chloride, and calcium chloride, for the other saline ingredients are present in amounts too small to lend more than feeble aid to those named. The next important feature of the baths, he says, is their temperature. Warm baths are debilitating, and exert a decided weakening effect on the heart even in health; so they are recognised as inadmissible in the treatment of disease of the heart. The temperature of the Nauheim baths ranges between 92° or 93° F. at first and 87° or a little lower toward the end of a course of treatment. At these temperatures, says Dr. Babcock, baths are cool, and even at 92° F. they impart a distinct feeling of chilliness to the patients as they enter them.

The duration of each bath is limited, and is increased cautiously with the progress of the treatment and improvement of the patient's condition. From five or eight minutes as the initial limit, the baths gradually reach a duration of twenty minutes.

If the pulse is watched during the bath, it will be found to become slower, fuller, and stronger, and if it was irregular in rhythm before, it is likely to improve even to the extent of attaining perfect regularity. Efforts on the part of the bather—such as speaking, forced breathing, moving about, etc.—generally occasion temporary irregularity and acceleration of the pulse. The respirations are generally slow and deep, partly in consequence of a feeling of oppression of the chest experienced by most individuals. This sensation of weight is not complained of by all in equal degree, however, and it is usually lost after a few baths. The improvement in the rate and quality of the pulse is an index of the degree of benefit derived by the patient. If not counteracted by exercise, this effect on the pulse will persist for an hour or two subsequently. Changes for the better in the size of the area of cardiac dulness and in the sounds may be noted likewise. This has been demonstrated repeatedly, says Dr. Babcock, both on himself by a competent Russian physician and by himself on others. Careful percussion immediately before and after a bath of from eighteen to twenty minutes' duration showed a demonstrable retraction of the deep limits of cardiac dulness, and the heart sounds were improved in strength, the second pulmonary being less accentuated, the second aortic stronger, the abnormal difference between the two sounds before being appreciably less marked after the bath. Murmurs that are almost inaudible before become intensified; and, conversely, some loud bruits are lessened in intensity.

In short, so far as can be determined by physical examination, these baths appear to lessen the rapidity and increase the force of the heart's contractions, thereby occasioning a better filling of the great arterial system with corresponding depletion of the engorged veins. This is borne out by experiments on animals conducted by Dr. August Schott, which demonstrated, by means of a mercurial manometer placed in the trachea, that a rise of arterial pressure was the result of nearly complete immersion in a saline solution. In this respect, therefore, the effect of these baths is similar to that following the administration of digitalis: both lengthen diastole and augment the force of systole. In addition, digitalis exerts a powerful influence as a vaso-motor constrictor, which action sometimes offsets its beneficial effect on the heart. This action on the vascular system is felt by all the arteries alike. Herein, it seems to Dr. Babcock, lies the difference between the effect produced by digitalis and that exerted by these baths. Experiments have demonstrated that the contraction of cutaneous vessels effected by cold baths occasions at first increase of blood-pressure and of the frequency and strength of the heart's contractions, but that later on the acceleration gives place to a retardation of the rate. The pulse, therefore, becomes slower and stronger during a cold bath, provided this is not continued until vaso-motor paresis sets in. Thus far a cold bath of moderate duration affects the heart in its contractions in the same way

as digitalis, although the mechanism by which this result is accomplished differs.

On the other hand, says Dr. Babcock, Schüler has shown that the application of cold to the abdomen—that is, contraction of the cutaneous vessels of the abdomen—is followed by prompt dilatation of the vessels of the pia mater; whereas heat applied to the abdomen is succeeded by constriction of the vessels of the pia mater. From these experiments it is probable that the effect of a cold bath is not to cause contraction of internal as well as of cutaneous vessels, but that a cold bath is followed by dilatation of internal vessels. In short, during and after a cold bath of moderate length, the heart contracts more slowly and forcibly. Furthermore, although there is not a *consensus* of opinion as to the balneological effect of mineral waters, whether or not their saline and gaseous constituents serve as mild stimuli to the sensory nerves of the integument, it is probable, as remarked by Leichtenstern, that they act as vaso-motor dilators, since cutaneous redness follows their prolonged use in degrees of considerable strength.

From the foregoing facts, and from the empirical knowledge of the beneficial effect of a balneological treatment of many cases of heart disease, Dr. Babcock deduces the following as the *modus operandi* of these baths:

Upon the patient's entering the bath there is an initial or primary constriction of the cutaneous vessels produced by the cold. This is promptly followed by a dilatation of the internal vessels and stimulation of the heart; its contractions, at first perhaps accelerated, become subsequently reduced in rate and augmented in force. After a moment or two the sensation of chilliness gives place to one of warmth, when it is probable the contraction of the cutaneous vessels grows less; the gentle stimulation of the sensory cutaneous nerves produced by the salt serves, however, to maintain the increased energy in the cardiac contractions. This secondary feeling of warmth does not act like a primary application of heat to the surface of the body by causing contraction of internal vessels; their dilatation persists. Under these conditions, says Dr. Babcock, the heart not only has less labour to perform, but is actually aided in the accomplishment of its decreased task. Like digitalis, the baths slow and strengthen the cardiac contractions, but, unlike digitalis, they dilate rather than contract the arterial system, or, in other words, reduce rather than increase peripheral resistance.

The light exercises, or, as the Schott brothers choose to designate this part of their cardiac therapeutics, the gymnastics, says Dr. Babcock, are an extremely simple but important adjunct to the baths. The individuality of this treatment lies in the application of counter-resistance made by an attendant trained for that purpose. He must see to it that the movements are performed slowly and steadily, that they are interrupted by short periods of repose, and that the effort exerted by the patient is not so great as to cause embarrassment of respiration or undue acceleration of the pulse. The attendant must watch lest the patient hold his breath and thereby overstrain the already feeble right ventricle, and must at once call a halt upon evidence of dyspnœa. Finally, he must so apply his counter-pressure as to offer resistance but not hinder free movement of the extremity. This requires some judgment and skill, yet is not so difficult as to be beyond the acquirement of an intelligent friend or relative, who can then help the patient to continue his exercises indefinitely after the latter has passed from the physician's daily superintendence.

These exercises exert an effect on the heart and circulation similar to that of the baths, and therefore supplement and re-enforce the balneological treatment. If they are properly performed, and if the resistance is judiciously apportioned to the patient's endurance, they slow the rate and augment the force and volume of the pulse, as has been repeatedly shown by the sphygmograph and sphygmomanometer. Percussion and auscultation reveal the same improvement in the size of the dilated heart and in the character of its sounds as after a bath. Patients not infrequently comment on their feeling of *euphoria* succeeding this form of treatment; dull præcordial pain, discomfort, or sense of oppression gives place to a condition of ease and lightheartedness. On the other hand, if too great resistance is applied, there is produced a sensation of cardiac distention with a variable degree of dyspnœa, while the pulse grows more rapid and feebler. Improved arterial circulation is so manifest a result of these exercises that Dr. Schott has known them to lessen the frequency, nay, even the severity of attacks of *angina pectoris* in individuals with arteriosclerosis who had been unable to indulge in even very moderate physical exercise taken in the ordinary ways of walking, etc. Permanent amelioration of the sufferer's condition has been achieved in some of these cases.

In regard to contra-indications, Dr. Babcock thinks there can be no doubt of the dangers of the treatment in degenerative changes of the blood-vessels and myocardium, such as aneurysm and advanced arteriosclerosis, acute softening, and great fatty degeneration of the heart. In these conditions rupture might result from heightened intravascular and intracardiac pressure. Furthermore, the query has been made as to whether chronic interstitial nephritis is not also a contra-indication on account mainly of the danger of setting up acute inflammation of the kidneys. It might be urged, in the second place, that the increased vascular tension produced might prove disastrous by augmenting the heightened arterial tension already existing.

To the former objection Dr. Babcock replies that when Dr. Schott was questioned on this point, he stated that he did not consider chronic interstitial nephritis a contra-indication to the baths. It would seem, adds Dr. Babcock, as if the stimulating action of the salts and carbonic acid on the skin rendered the effect on the kidneys different from that of a bath in plain water at the same low temperatures.

As regards the dangerous augmentation of existing vascular tension to the extent of either

rupture of a blood-vessel or of stretching the cavity of the left ventricle, Dr. Babcock suggests that such baths would not be administered so long as the hypertrophied heart was adequate to the peripheral resistance to be overcome. They would be given only when the cardiac energy was threatening to fail or had actually failed. Under such circumstances the only thing that could preserve the patient would be a restoration of the heart's power. This might be possible if the heart's walls were not too degenerate and the kidneys not greatly contracted. Moreover, if the baths in question brought about even a slight degree of dilatation of the internal vessels, he adds, then the peripheral resistance would be lessened rather than increased; and if the circulation was thereby improved, so likewise would be the action of the kidneys.

The resisted exercises, the *Widerstandsgymnastik* of Ling, are fully described and figured in Dr. W. Bezly Thorne's work entitled *The Schott Methods of the Treatment of Chronic Diseases of the Heart* (London, 1895). Dr. Rives (*loc. cit.*) gives the following synopsis of them:

1. Movements of the extended arms in three directions.

(*a*) From the ordinary position by the sides of the body forward and upward until they reach the temples, and back again.

(*b*) From the same position laterally outward and upward to the temples, and back.

(*c*) From the horizontal position, with the palms of the hands meeting in front of the body, as far apart as possible, and back.

Rotation of the extended arms about their axes as fully as possible, causing pronation and supination.

2. For the elbow, wrist, and finger joints the natural flexions and extensions; radial and ulnar abduction and adduction.

3. (*a*) Flexion of the trunk forward, from a little beyond the erect position, and back.

(*b*) Lateral flexions of the trunk to right and left, and back.

(*c*) Rotations of the trunk on its axis to right and left, and back.

4. Movements of each extended leg forward and upward, outward and upward, backward and upward, and back.

5. The natural flexions and extensions of the knee and ankle joints.

The resistance, says Dr. Rives, is always made by the attendant with the palm of the hand in the direction exactly opposite to that of the movement, and in applying it to the wrist and ankle these parts are placed in the fork formed by separating the thumb and fingers; but a limb is never actually grasped, lest support rather than resistance should be the result.

The degree of force employed, says Dr. Rives, should be as much as the patient can overcome without the slightest discomfort, and should be so uniformly applied as to enable him to perform the movements slowly, evenly, and without jerks. He must be able to breathe quietly, and the mouth and alæ nasi must be watched carefully, so that at the slightest indication of loss of breath a pause may be made. Some of the movements may be omitted according to circumstances; the most trying to the patient are the elevation of the arms above the head and the trunk exercises. The limbs are not allowed by the attendant to fall suddenly after the completion of a movement; a considerable interval of time is always allowed between the movements, and this is prolonged if the patient seems at all fatigued. The clothing should, of course, be perfectly loose and easy. The exercises are usually given for about half an hour, the series being gone over twice in that time, but they are often employed for shorter or longer periods.

Dr. Rives adds that Dr. Schott has also devised a scheme by which the services of the attendant may sometimes be dispensed with. In carrying out these self-resisted exercises (*Selbsthemmungsgymnastik*), as they are called, the patient endeavours, as it were, to resist his own movements by partially contracting at the same time the antagonistic muscles. This demands some intelligence on his part, and it would often be unsafe to allow its employment.

The action of these exercises, Dr. Rives remarks, is to produce an effect similar in many respects to that caused by the baths; the cold extremities become warm, the sense of oppression in the chest is relieved, and the breathing is deepened. The pulse usually becomes fuller, stronger, and slower, and an immediate diminution in the area of dulness of the dilated heart, not due to increased overlapping by the lung, with a simultaneous lessening of the dimensions of the passively congested liver, have been frequently demonstrated. The effect is often very speedy and striking; according to Dr. August Schott, an attack of *cardiac asthma* which would otherwise continue for hours may be charmed away, as it were, in a few minutes, and an extreme dilatation be for the time being so completely dispelled that hardly a vestige remains.

In fresh *endocarditis after rheumatism*, says Dr. Rives, the baths promote to a high degree the absorption of the inflammatory products and offer hopeful prospects of a more or less complete cure. In *chronic valvular disease*, where there is serious damage to the valve segments, they can not ordinarily produce the slightest effect upon the injured valve itself, and those murmurs which disappear during the course are due to relaxation of the orifices or want of tone in the papillary muscles. Dr. Groedel, of Nauheim, however, states that he has met with a very few remarkable cases presenting evidences of fully developed valvular disease which have been cured at Nauheim, one of which is mentioned in Professor Eichhorst's *Handbuch der speciellen Pathologie und Therapie*, fifth edition, vol. i, p. 56. This patient had all the signs of pronounced *mitral insufficiency*, and these so entirely disappeared after two seasons at Nauheim that he was accepted as sound by a very strict life-insurance company. At the end of ten years there was still no trace of the disease. Although we

can not expect, says Dr. Rives, that seriously injured valves should be restored to their normal condition, failure of compensation resulting therefrom is signally benefited, and it is in those cases especially in which digitalis is not tolerated or has not proved useful that the results are so astonishing. It is well known that in aortic regurgitation digitalis is not always beneficial. Good results are secured at Nauheim, however strange it may at first appear, in lack of compensation both from aortic and from mitral disease, as well as in cases of combined disease of both valves and in many instances of patent foramen ovale. The gradual influence exerted upon the nutrition of the heart, without the other accompanying undesirable effects which are often a cause for the failure of medicinal treatment, offers an immense advantage.

In *weak hearts* without serious organic lesion, from anæmia, chlorosis, and convalescence from acute diseases, and the myocardial affections resulting from influenza, most excellent results are obtained, according to Dr. Rives, particularly in young subjects, as well as in cases of heart strain and dilatation due to over-exertion. In the chronic sclerotic changes (arteriosclerosis, chronic myocarditis) of the heart and vessels and fatty degeneration, with or without dilatation, so frequent in persons of advancing years, of which the ordinary treatment is usually palliative, the benefit to be derived is naturally more uncertain and generally requires long and persistent treatment. Some of the most remarkable results of the Schott methods, however, have been obtained in apparently hopeless cases, and even patients suffering from *angina pectoris* have been practically cured at Nauheim. While many cases of angina pectoris are hopeless under any circumstances, says Dr. Rives, yet the effect of the Nauheim baths upon the cardiac nutrition is so remarkable that where the lesions are not too far advanced or only incipient the results of the treatment are eminently gratifying. He cites Balfour's statement that the expression pseudo-angina is often misleading, and should not be applied to cases presenting symptoms identical with those of true angina, merely because the heart lesion happens to be curable. Such cases it is often impossible to distinguish from the incurable ones, and Balfour consequently expresses himself in regard to the prognosis to the effect that this is often more hopeful than we should at first be led to suppose.

The results in cases of heart disease dependent upon or complicated with disease of the kidney, says Dr. Rives, are less encouraging and more variable, but albuminuria due merely to secondary renal congestion may altogether disappear. Cases of functional nervous disturbance of the heart are usually, but not always, benefited.

The contra-indications to the Nauheim treatment are stated by Dr. Rives, as by Dr. Babcock, to be advanced arteriosclerosis and aortic aneurysm. Patients with the latter affection, he says, have used the baths with some alleviation of symptoms, but on account of the danger of raising the blood pressure they must be employed with the greatest caution. Many persons with very serious heart disease come to Nauheim, he remarks, and, as is only to be expected, some deaths occasionally take place during the season; but such is the care taken by the local physicians, who write their orders with exact directions, that fatal accidents directly attributable to the baths are practically unknown. Groedel states that during a practice of many years at Nauheim he has never had a case of sudden death during the bath, although he has known of two cases of apoplexy which occurred during the exertion of dressing.

As to the exact length of time required for a cure, it is, of course, says Dr. Rives, impossible to say; improvement is usually observed after a week or two, and some patients are relieved by a single course, but many others require a much longer period, and there are comparatively few who are ill enough to undertake a long journey to Nauheim in search of relief for whom it is not advisable that they should return for another or several successive seasons, while in some desperate cases the treatment will necessarily fail.

In an excellent article on this method of treating heart disease (*Lancet*, March 21 and 28, 1896), Dr. R. F. C. Leith, of Edinburgh, says: "The physiological problems raised by 'the system' are both many and complex, and there must be much still hidden from us which the future may reveal, and which may bring about a more perfect understanding of its actions. So far as they are at present known to us, it is readily seen that its scope of application is far wider than that of any individual drug; but to assert its applicability to all classes of cardiac derangements, reserving only advanced arterio-capillary sclerosis, aneurysms, and serious myocarditis, is surely in so many words to proclaim its impotence. It is but natural that it should fail. Evil habits of nutrition which measure their existence by months or years are not to be got rid of by one or even two courses of 'the system' of a few weeks' duration at Nauheim or anywhere else. I have already met with failures and recurrences such as the present literature of the subject makes no mention of, and they have but served to increase my belief in its value when used in suitable cases. While we remember that it is also capable of doing much good we must not forget that it is also capable of doing harm. It has now been sufficiently proved to warrant its trial in suitable cases, but they must be chosen with judgment. To use it rashly, and with too great expectations, is certain to lead to disappointment and to reflect injuriously upon the system itself. Moreover, as at present enunciated, it does not seem to me to be as useful as it might be. It is at once too wide and too restricted; too wide in its claims and too restricted in its limitations. Why, for instance, should we pause at 86° F.? Why not go further in suitable cases and make use of the well-known effects of still lower temperatures, inasmuch as we can so easily regulate their influence by the duration of time we employ them. The resist-

ance exercises are good as far as they go, but why should they not be combined with massage or passive or active exercises of different kinds? Eccles, Campbell, and others have testified to their value. An intelligent use of dumb-bells and other gymnastic appliances ought to prove quite as effectual as the resistance exercises themselves, and they have done so in my hands in the opportunities I have so far had of putting them into practice."

Artificial Nauheim baths, says Dr. Rives (*loc. cit.*), may be prepared by dissolving the requisite percentage of required salts, or, as Dr. John Broadbent points out, by the use of sea water, which contains 2·7 per cent of chloride of sodium, and by adding for the production of carbonic acid suitable proportions of commercial muriatic acid and bicarbonate of sodium or chalk, or, as has been suggested, a mixture of the bicarbonate and bisulphate of sodium. The gas, however, when thus evolved, he remarks, escapes more rapidly than it does from the natural baths.

Dr. Rives thinks good results may undoubtedly be obtained in this way, and he adds that such baths have been employed by Dr. Bezly Thorne in London and by Dr. Babcock in Chicago, as well as in the Middlesex Hospital, with success; but the greater freedom from counteracting injurious conditions to be had at a spa, and the various advantageous mental and hygienic influences to which the patient is there subjected, he thinks, are sufficient reasons, even allowing the artificial baths to be as effective as the natural waters, why the results obtained at Nauheim are more striking than those reported from the cities. Mineral springs in the country, especially when possessing a part of the requirements, offer more promising opportunities, and provision has been or is being made at Harrogate and various places in England for carrying out the treatment.

In administering the Nauheim baths to patients with heart disease, says Dr. Rives, several varieties are employed, for when the effect of one kind of bath becomes less and less marked, owing to the nervous system gradually becoming habituated, a fresh stimulus is imparted by changing to a stronger bath, and thus a longer course can be taken than would otherwise be advantageous. The method employed by Dr. Theodor Schott, which is in the main practised by the other Nauheim physicians, is the following: The first bath ordered (*thermal Soolbad*) is supplied by the water taken from the receiving basins, from which by exposure to the air a large part of the carbonic acid has escaped, and a considerable proportion of iron and salts has been precipitated, so that it is of a muddy colour and contains few or no bubbles of gas. No. 7 is the spring usually first employed, as it contains the smaller proportion of salts, 2·18 per cent. of chloride of sodium and 0·17 of chloride of calcium. Dr. Schott recommends for some cases, at the beginning of treatment, baths containing only 1 per cent. of chloride of sodium and 0·1 per cent. of chloride of calcium. The natural temperature is 88·8° F., but this at first is raised to one varying from 92° to 95° F. Temperatures above that of No. 12 spring, 95·5° F., are not suitable for heart patients. The duration of the bath, at first six to eight minutes, is gradually lengthened every few days, one minute at a time, while at intervals the temperature is lowered about one degree (half a degree centigrade).

At first every second or third day, afterward every fourth or fifth, the bath is omitted. The percentage of salts is now gradually increased, which may be done at first by mixing the waters of Nos. 7 and 12, but is usually accomplished by adding a quart of Nauheim "*Mutterlauge*" (mother-lye)—the uncrystallizable liquid left behind in the manufacture of salt—which is subsequently increased to two and three quarts, or occasionally even more. The main ingredient of this is chloride of calcium, which may be raised eventually in the bath to the amount of 0·5 per cent. When the proportion of salts is thus rendered sufficiently large, the temperature by this time having been lowered several degrees, and the duration extended to not more than twenty minutes, the patient is ready to continue treatment by a course of Sprudel baths from either No. 7 or No. 12, the former containing the greater amount of carbonic acid, the latter of salts. These differ from the others in being supplied with water direct from the springs, before it has undergone the action of the air, so that it appears of crystal clearness and filled with sparkling bubbles of carbonic acid, which it retains in undiminished quantity. They are likewise at first taken warm, usually at their natural temperatures, and for a short time—about eight minutes—and as they are continued the temperature is lowered in the same cautious way and the duration prolonged in like manner. The saline contents may also be increased by successive additions of "*Mutterlauge.*" In consequence of the powerful excitation of the cutaneous circulation by the carbonic acid, which creates an agreeable feeling of warmth, says Dr. Rives, the temperature can be lowered to a degree which could not be otherwise tolerated, but is seldom if ever reduced below 80° F. The final, most powerful form of stimulation is the *Sprudelstrombad*, in which the supply and overflow pipes of the bath tub are left open, so that in addition to the fresh supplies of carbonic acid, the shock of the running water against the body is experienced.

BELLADONNA.—Dr. Douglass W. Montgomery, of San Francisco (*Medical News*, November 16, 1895), has observed decided benefit from the use of belladonna in the form of *pemphigus* known as *hereditary inclination to the formation of blebs.* After a trial of arsenic and then of potassium iodide (on the possibility that the trouble was syphilitic) without result, Dr. Montgomery prescribed for the patient, a boy fifteen years old, 3 drops of tincture of belladonna, and the dose was increased in a few days to 4 drops. Decided improvement then set in and for about a week no new blebs formed. A few new blisters then appeared and the dose of belladonna was increased up

to 6 drops three times a day, but without entirely controlling the formation of the blebs. The patient now disappeared for a number of months, and on his return Dr. Montgomery hit upon the probable mode of action of the belladonna. One of the best-known actions of belladonna, he remarks, is its power of controlling perspiration, and he was then led to think that if this was the only action of the drug, it would be as well to use it locally; a small amount was applied to the soles, and with satisfactory results. Blebs formed, but not in sufficient numbers to especially incommode the boy, and the disease was rendered tolerable.

BENZONAPHTHOL.—Dr. José A. Clark (cited in the *Lancet* for July 20, 1895) reports having employed benzonaphthol in an epidemic of *dysentery* which occurred in Alquizar, Cuba, during which he had one hundred and thirty-seven cases of the disease under treatment, of which he considered twenty-three as serious and a hundred and fourteen as of a mild type. The mortality among those treated with ipecacuanha and calomel, opium, etc., amounted to 9 per cent., while that among those treated with benzonaphthol was scarcely more than 2 per cent. This drug had the great advantage of not causing vomiting, salivation, or depression of the circulation, and it also brought patients through the attack more rapidly than the drugs generally used. Forty-five grains per diem were given to adults and but little less to children.

BENZOYLANILIDE.—See BENZANILIDE.

BENZOYL-BETA-NAPHTHOL.—See BENZONAPHTHOL.

BISMUTH.—The *Deutsche Aerzte-Zeitung* for February 1, 1896 (*New York Medical Journal*, February 22, 1896), calls attention to a soluble *phosphate of bismuth*, "bismutum phosphoricum solubile," a salt that contains about 20 per cent. of oxide of bismuth. Even concentrated solutions of it remain clear for some hours, and a solution containing from 1 to 2 per cent. of the salt will remain clear for days, but it is rendered turbid by boiling, also by the addition of an acid or of an alkali. The reaction of such a solution is feebly alkaline, and its taste is not very pronounced. Soluble bismuth phosphate has no effect on the micro-organism of anthrax or on other like resistant germs, but it seems capable of arresting the development of the *Bacterium coli*. Experiments on animals have shown it to be harmless. The dose necessary in its therapeutical employment is much smaller than that of any of the powdery preparations of bismuth; from 3 to 8 grains are to be given three times a day. It has been used as a remedy for *cholera infantum* with good results.

The following formula is attributed to Dörffler:

℞ Soluble bismuth phosphate. 1½ to 2 parts;
Distilled water..... 90 "
Syrup of marsh mallow.... 8 "
M. A child's spoonful to be given every hour

In most cases the vomiting ceased after the first few doses, and the intense odour of the stools was mitigated as soon as they became black in appearance, denoting that the drug was doing its work in the intestine. From profuse diarrhœa, the intestinal evacuations were reduced to two or three in twenty-four hours. No milk was given. In the majority of cases the disease was at an end in the course of a few days. The writer thinks it advisable to continue the use of the remedy for some days after the diarrhœa has ceased.

BLANCOLINE.—This is a white, odourless substance prepared in two forms, solid and liquid. It is used like vaseline.

BLENNOSTASINE.—This is a bromine derivative of cinchonidine, $C_{19}H_{24}N_2OBr_2$. Dr. Walter F. Chappell (*New York Medical Journal*, December 5, 1896) says that it crystallizes from dilute solutions in large, prismatic crystals, or from concentrated solutions in the form of small, needle-shaped crystals, very soluble in water and quite as bitter as quinine. He says that it has a marked contractile effect on the vaso-motor system of the upper respiratory tract, and, being non-toxic, is especially valuable as a substitute for belladonna, atropine, and similar drugs in *hay fever*, *acute influenza*, *rhinitis*, *intermittent rhinorrhœa*, *laryngorrhœa*, and *bronchorrhœa*, has a powerful sedative influence on the brain and spinal cord, and decidedly diminishes reflex movements.

Blennostasine may be administered in capsule form, when combinations are required; but for many reasons Dr. Chappell thinks one-grain gelatin-coated pills are preferable. The dose ranges from 1 to 4 grains or more every hour, according to the effect desired.

BOROLYPTOL.—This is an American proprietary antiseptic preparation, presumably so named because boric acid and oil of eucalyptus are prominent ingredients of it.

BROMATED HÆMOL, BROMHÆMOL.—This is a derivative of hæmogallol (*q. v.*) said to contain 2·7 per cent. of bromine. It has been recommended in the treatment of *epilepsy*.

CAJEPUT, CAJUPUT.—Mr. Ram Dhari Sinha, L. T. M. S. (*Indian Medical Gazette*, December, 1896), reports having used cajuput oil internally as an *expectorant* in eighteen cases of *pneumonia*, with satisfactory results. Ordinarily he gives 5 minims, either made into an emulsion or simply shaken with water, every four or five hours. In all the eighteen cases the *dyspnœa* and *cough* were diminished and expectoration became easier. All the patients recovered.

CALCIUM CARBIDE.—This compound, CaC_2, is in the form of irregular lumps of various shades of gray. On contact with water it decomposes and acetylene gas is generated. Some of the French surgeons have lately employed it in the treatment of *cancer of the uterus*. M. Peyrot, according to M. Guinard (*Gazette médicale de Paris*, April 18, 1896), has

employed it in the following manner: A piece of the calcium carbide is placed directly in the vault of the vagina, where it very soon becomes decomposed into calcium oxide and acetylene by contact with the moisture. At the end of several days the oxide is removed by means of irrigation with corrosive sublimate. This treatment may be repeated several times. The results are very appreciable, says M. Guinard, for the diseased parts assume a grayish tint and become smooth, and the hæmorrhages, the fœtid discharge, and the pain are suppressed.

With regard to the mode of action of calcium carbide, says M. Guinard, it is rather complex. The nascent quicklime acts, he thinks, in concert with the acetylene, which passes into the urine, where it has been found. Perhaps, he says, by contact with the cancerous elements, it leads to a sort of special coagulation of the blood, analogous to that observed in persons poisoned with gas.

M. Livet (*Thèse de Paris; Revue internationale de médecine et de chirurgie*, September 25, 1896), acting on M. Guinard's idea, has employed calcium carbide, not only in the treatment of uterine cancer, but also in that of other affections accompanied by *rebellious hæmorrhages*, *pain*, and *fœtid odours*, such as certain forms of *fibroma* and *metritis*. He reports eight cases, four of which demonstrate that the treatment with calcium carbide is always followed by an amelioration, whether in *cancer of the breast*, *metritis*, or *epithelioma of the uterus*. In cases of cancer of the neck of the uterus, he says, the vulva and the vagina should first be thoroughly washed and disinfected, and then pieces of calcium carbide should be placed in the inequalities of the tumour. If a calcium-carbide crayon is to be introduced into the cervical cavity, it must be done very rapidly, for when it comes in contact with the moist mucous membrane it produces a bubbling and nothing more is seen of it. In cancer of the breast the cavities are simply filled with pieces of calcium carbide.

In order to confine the acetylene, an ordinary dressing is used on the breast and tamponing is employed in the vagina. The action of calcium carbide is very rapid; the patient feels at once a burning sensation which lasts for an hour or two, and at the end of that time the pain, the discharge, and the fœtid odour have disappeared. The clot which is formed by the coagulant action of the acetylene presents a temporary barrier, which is sometimes definitive, to the hæmorrhage, and when the fœtid discharge is dried up the nauseous odour disappears. When the tampon of iodoform gauze which confines the acetylene is removed the vegetations will be seen to be diminished in volume and covered with a grayish eschar which is easily detached with a blunt curette. It is not necessary to renew the applications of the carbide oftener than every four or five days, unless the hæmorrhage should reappear on the day following the first application. If it is necessary to use the nascent lime to hasten the destruction of the neoplasm, the applications of the carbide may be more frequent. In all cases the treatment, being purely symptomatic, should be continued until the fatal termination, which will be more or less retarded.

According to M. Livet, the unpleasant effects of this treatment are few; in one case he observed diarrhœa and in another burns on the vaginal wall. Unfortunately, he says, the treatment is painful; the burning sensation is very intense and occasionally persists for a long time.

CALCIUM CHLORIDE, according to Dr. Thomas D. Savill (*Lancet*, August 1, 1896; *New York Medical Journal*, August 22, 1896), is a very efficacious remedy for the *itching* that accompanies certain skin diseases.

In all the cases which have come under his observation, he says, the itching has been relieved, and the eruption, if any existed, has disappeared at the same time. He states further that he has not met with any absolute failures so far, although sometimes the dose has had to be considerable and the employment of the drug continued for several weeks. The opportunity of trying the remedy in children for the itching that accompanies *urticaria*, he says, has not presented itself, but there is every reason to believe that it would be equally efficacious in such cases.

Dr. Savill says that the doses must be considerable, not less than 20 grains three times a day, and they should be gradually increased. Thirty and even 40 grains have often succeeded where smaller doses have failed. If administered after meals and in a wineglass of water it is surprising how little these large doses upset the stomach, and he states that he has never known them to produce vomiting. Patients sometimes complain, he says, that it makes them thirsty, and to cover the salt taste it is best administered with a drachm of tincture of orange peel and an ounce of chloroform water, in which form it is really an agreeable medicine and would be well taken by children. It is important, says Dr. Savill, that at the same time the diet should be regulated, no beer, sugar, or sweets being allowed, and meat only in very moderate quantity. It is also important to keep the bowels acting freely. Although improvement is generally noted after the first dose, he says, complete recovery is sometimes not obtained until the blood becomes saturated, and the dose must be increased until this is accomplished. In long-standing cases perseverance is necessary.

When recovery is obtained the dose should be gradually, not suddenly, reduced, and it is very important that the use of the remedy should be continued for at least from one to three weeks after all symptoms have disappeared. It is not possible yet, he thinks, to indicate precisely which cases are most suitable for this treatment, but it is worth trying in all cases where itching is a pronounced feature. In most of his cases an actual cure resulted, but in a few of very long duration relief was obtained only so long as the drug was being taken. Nevertheless, a cure, he thinks, will probably result with perseverance even in these.

Dr. William Huntly, of Kotah (*Indian Medical Record*, May 1, 1894; *New York Medical Journal*, June 16, 1894), speaks highly of calcium chloride as a *hæmostatic*. In a case of *bleeding after the extraction of a tooth* the flow was arrested by the administration of opium, but returned on the following day, when Dr. Huntly gave the patient calcium chloride, and by evening the bleeding had stopped. In this case the use of calcium chloride was continued for three days. In another case vomiting of blood had gone on all night, and every native remedy had been tried unsuccessfully. Dr. Huntly thought it clear that the *hæmatemesis* was due to an irritant powder having been swallowed by mistake, and he ordered some soap pills to be taken at once. After the use of calcium chloride, together with other measures, there was no recurrence of the bleeding. In a case of severe *epistaxis* the same measures proved effectual without resort to plugging. Dr. Saundby, says Dr. Huntly, has obtained good results in a case of *purpura hæmorrhagica* from 6-grain doses of calcium chloride repeated every two or four hours. Dr. Huntly thinks better results are to be obtained from the combination of opium and calcium chloride than from either drug alone, although opium by itself has often proved successful, as nature mends the broken surfaces while the opium is exercising its restraining influence; but when calcium chloride is added, Nature's efforts are supplemented. Opium, he continues, acts on the smaller arterioles and capillaries, while calcium chloride acts through and on the blood, and the combination is all the more valuable because their spheres of action do not clash. As a combination, he thinks that calcium chloride and opium should be found superior to lead and opium.

CALCIUM SULPHIDE.—Dr. J. Sinclair Coghill (*British Medical Journal*, May 4, 1895; *Therapeutic Gazette*, September, 1895) reports a large experience in the use of calcium sulphide for the *prevention of influenza*. He gives it in pills, each containing a grain, and one pill is to be taken daily. During the first epidemic in which he used it all his household took it, with the exception of two servants, who, for some reason or other, did not, and the result was that all escaped except the two servants. The next year, when the epidemic again broke out, the writer asked the authorities of the Isle of Wight Railway to supply all their employees with the pills, and all who took them regularly escaped. The manager of the Central Railway also asked Dr. Coghill to supply his men with them, and he afterward informed him that, so far as he could ascertain, none of the men who had taken the pills regularly had had influenza. During the next outbreak the pills were again given, with like results; but on the Isle of Wight Railway they were not given out to each workman as formerly, consequently but few took them, and the result was that a large number of influenza cases occurred among those who had not used the remedy.

It takes about three days, says Dr. Coghill, before the system becomes sufficiently saturated with the drug to prevent infection; therefore it is rarely of use to those who have already been exposed to it, though even then it appears to modify the attack. When a case appears he believes the 5-grain dose of quinine to be more rapid in its action than the sulphide of calcium, and therefore safer to give, but he would afterward carry on the effect with the sulphide of calcium, which is equally efficacious and much easier for many to take, as it never appears to disagree in any way, although taken regularly for many weeks. Its *modus operandi* is thought to be that of rendering the blood unfit to receive and support the germ of the disease.

CAMPHORIC ACID.—Dr. Ralph Stockman (*Edinburgh Medical Journal*, January, 1897; *New York Medical Journal*, January 16, 1897) refers to the early experiments made by Gormanni and Brugnatelli, the results of which showed that this drug readily destroyed the tubercle bacillus, and that sputum after treatment with it failed to infect rabbits. Fürbringer, he says, used it as an *intestinal antiseptic* in *typhoid fever*, and found that it greatly diminished the number of organisms in the alvine discharges, but had no effect on the duration or the severity of the fever. In the course of these observations it was noticed by Fürbringer that it checked the secretion of sweat, and he then began to use it in cases of *phthisical sweating*. Other trials, says Dr. Stockman, by Dreesmann, Bohland, Niesel, Combemale, and others have confirmed this observation; and all these investigators speak highly of its action and place it in the very first rank as an *anthidrotic*.

Dr. Stockman states that it has been used only to a comparatively limited extent, and that, although it is said to act more powerfully than either atropine or agaricin, the experience on which this opinion is founded is not very extensive. He himself began to use the drug four years ago, and since then he has given it pretty largely in phthisical and other cases of sweating. One case was that of a lady who had been treated by electricity for a myoma of the uterus. She suffered greatly at night from excessive sweating, and occasionally also during the day. Dr. Stockman ordered her 15 grains of camphoric acid at night, and this completely stopped the sweating. After taking it for two weeks she found that the tendency to excessive sweating had completely disappeared, and since then it has not recurred. Shortly afterward Dr. Stockman again used it successfully in a patient with enlarged prostate, who suffered from profuse sweating without any apparent cause. This tendency to perspire profusely has recurred at intervals, but is always stopped by 15 grains of camphoric acid taken once or twice a day, and sometimes one dose is sufficient. Dr. Stockman has also used it in cases of *hyperidrosis after influenza* and in other cases in which there was certainly no tubercle present, and in all of them doses of from 15 to 30 grains have given good or fairly satisfactory results.

Dr. Stockman emphasizes its value in non-tuberculous cases, because it has been stated that its usefulness is confined to the sweating of phthisis, in which its value is quite comparable to that of belladonna or atropine. According to his experience, camphoric acid acts as efficiently as atropine, but in one or two obstinate cases it has not shown itself so powerful an anthidrotic as picrotoxin. It exercises, he says, no specific germicidal action on tubercle bacilli in the tissues, and it does not affect the fever or local lung condition.

With regard to its administration, Dr. Stockman thinks that the best plan is to give 30 grains at night two or three hours before the sweating would begin, or it may be given in two doses at short intervals. It is best administered in powder or in capsules or cachets, as the alcoholic solution is very bitter. Owing to its insolubility, he says, it is only slowly absorbed from the intestinal canal, and this is the reason why it must be given so long before the time of sweating. This slowness of action is, Dr. Stockman thinks, undoubtedly a drawback as compared with that of atropine or picrotoxin, which can be given hypodermically and act rapidly. Camphoric acid is excreted in the urine within twelve hours after its administration by the mouth, so that its action is usually not very prolonged.

The only unpleasant effect seen by Dr. Stockman has been slight irritation of the stomach after its use. It is said, however, to cause renal irritation, and in one case it was apparently the cause of a skin eruption. It seems to be non-poisonous, he says, even in large doses, and in this respect has distinctly an advantage over belladonna, picrotoxin, and agaracin. Fürbringer has given as much as 75 grains a day in typhoid fever, and Niesel gave 750 grains in four weeks in a case of cystitis, without any toxic or unpleasant symptoms being produced. He adds that his own experience also bears this out, as he has never noticed any depression of the heart or nervous system, and Wagner has found that camphoric acid has much the same effect as camphor on the circulation, that it acts as a *stimulant to the heart* and raises the blood-pressure.

In order to ascertain its mode of action, Dr. Stockman made some experiments on frogs and on sweat secretion in cats. The experiments on frogs showed that it was not very toxic to these animals. Doses of from 2 to 4 grains by the mouth or subcutaneously caused slight depression which lasted for some hours and was then succeeded by great increase in the spinal reflexes which lasted for several days. Given in this way, it scarcely affected the motor nerves and muscles, but if the same dose was injected directly into the aorta of pithed frogs, both motor nerves and muscles were paralyzed. Its action differs, therefore, very considerably from that of camphor. Doses up to 75 grains had very little effect on rabbits beyond causing slight depression sometimes followed by a very slight increase of reflexes. The toxicity of camphoric acid is therefore, remarks Dr. Stockman, very slight in animals as well as in man.

CANNABIS INDICA.—The *Therapeutische Wochenschrift* for March 1, 1896 (*New York Medical Journal*, March 21, 1896), mentions a new watery fluid extract of cannabis indica termed *extractum cannabis indicæ aquosum fluidum*, and states that, according to R. Cowan Lees, it possesses all the beneficial properties of the plant, but does not give rise to that state of intoxication, bordering on poisoning, which sometimes follows the use of even medium doses of the alcoholic preparations. It has no effect on the secretion of bronchial mucus, and consequently in suitable cases it seems more efficient than opium, and it has a manifest *anodyne* and *hypnotic* effect in *pulmonary affections*. Lees has observed the best results from its use in *tuberculous disease of the lungs*, in which it materially alleviates the paroxysms of coughing, while at the same time it exerts the precious stimulating and cheering effects of cannabis indica. It is, furthermore, of value in digestive disturbances connected with constipation and as a soporific in the diseases of children. The medium dose for an adult is from 30 to 60 drops; for a child less than a year old, from 0·15 to 0·30 of a drop for each month of age; for older children, from 1½ to 3 drops for each year of age.

CARBAZOTIC ACID.—See PICRIC ACID.

CARBOLIC ACID.—In the *Lancet* for January 16, 1897, Mr. Arthur Eddowes, of Loughborough, reports a new case of *traumatic tetanus* cured by the subcutaneous administration of carbolic acid. A man, aged forty-one years, received a punctured wound on the inner side of the ball of the left great toe from a boot nail on or about May 19th. Little notice was taken of the wound at the time, and he continued his work. On the 26th he got very wet, and thought he had contracted a chill. About June 2d the wound was observed to suppurate slightly, but he still did his work. On the 9th he felt slight stiffness of the lower jaw and of the nape of the neck; the latter sensation was described "as if something was constantly pulling his head backward." On the 10th, the symptoms being slightly worse, he consulted his medical man, who prescribed for him. He visited the practitioner again on the 11th and 12th, but he still continued his work. On the morning of the 13th he was advised by the medical man to go home and go to bed, but he did not do so till 6 P. M. During these days the symptoms had been steadily increasing in severity, and by the 13th his condition was as follows: His jaws were quite closed, so that slops only could be taken. The muscles of the back were slightly rigid, sufficiently so to make movement difficult. By the next morning (June 14th) there was fully developed trismus with severe aching pains in the muscles around the lower jaw, rigidity and arching of the neck, rigidity and slight arching of the back, and some contraction of the abdominal walls; the lower extremities were not much complained of except for shooting pains round the knees; the upper extremities were free. The urine

passed normally; the bowels were acted upon by 2 grains of calomel given the previous evening: the surface of the body was somewhat clammy. The pulse was 66 and of good volume, and the temperature was 98° F. His intellect was clear; the power of swallowing was not perceptibly affected, the patient being easily fed with slops owing to the absence of several teeth.

The treatment consisted in the administration of chloral hydrate and bromide of potassium every four hours and liquid food. On the 15th the arching of the neck and trunk was somewhat more extreme; the trismus was still marked, and there was some degree of risus sardonicus observable. Also there was considerable pain complained of, beginning in the spine and shooting forward. The power of the extremities, however, remained good; the urine passed normally, but the bowels were not open. The pulse and temperature were the same as on the 14th. On the 16th his condition remained unchanged. On the 17th occasional momentary convulsive movements of the trunk, simulating hiccough, were observed, the arching of the neck and trunk was increased, and the power of the lower extremities was slightly lessened. There were considerable pain and some tenderness of the spinal column. The pulse was 72 and the temperature was normal; the urine passed normally, but it was highly concentrated and loaded with urates; the bowels were opened by an aperient and an enema. On the 18th the rigidity of the neck was less extreme, the convulsive twitchings were more frequent, and intense fœtor of the breath was noticed; otherwise the condition remained the same as on the 17th. A consultation was held, and the following treatment was adopted: Highly nourishing diet was ordered, consisting of eggs with milk and brandy, milk with soda water, jellies, and cocoa, frequently administered in small quantities. Ten grains each of chloral hydrate and bromide of potassium were administered every two hours. Five minims of carbolic acid (2-per-cent. solution) were injected hypodermically morning and evening. The chloral and bromide of potassium were given at 8 P. M., and were followed by intense excitement with numbness in the extremities half an hour later, which continued during the greater part of the night. The carbolic acid was injected at 10 P. M., and no after-effects were noticeable, the pulse being 102 and the temperature 100·8°. On the 19th, at 10·45 A. M., the pulse was 96 and the temperature 100·8°. The patient had become quieter, the convulsive movements were less frequent and less severe; he took his food well; his intellect was somewhat clouded, but he was conscious of his surroundings. There was less rigidity of the back, chest, and abdomen, and there was more power in the legs; there was no change in the degree of the trismus. The bowels were inactive, and an aperient and an enema had to be resorted to. On the 20th the pulse was 90 and the temperature was 99·8°. The convulsive movements were very slight during the night, but the patient was very restless. The rigidity of the back, chest, and abdomen was much lessened, the back completely resting on the bed; there was greater power in the lower extremities, but there was little change in the rigidity of the neck. The mouth could be opened slightly, but not sufficiently to allow of protrusion of the tongue. The bowels were still inactive, and an enema was given. The patient's condition had considerably improved by the afternoon, and the treatment was slightly changed, the hypodermic injection of carbolic acid being reduced to once daily and the chloral and bromide being given every three hours instead of every two hours as before. On the 21st the pulse was 72 and the temperature normal. The patient had had a restless night, but less so than the preceding one. The rigidity of the muscles was lessening, with the exception of those of the neck, which remained firm. The movement of the jaw was more complete, and there was less risus sardonicus. The bowels, however, had not been opened, in spite of a dose of castor oil. The use of the hypodermic injections was discontinued, and 15 grains of chloral hydrate were given three times a day. On the 22d the pulse was 78 and the temperature 98·2°. The rigidity had almost disappeared except in the neck and jaw. The patient was still restless, evidently from being confined to bed, and the bowels were still inactive, but the patient's condition was improving. On the 23d the pulse was 73 and the temperature normal. He had had a good night, but felt depressed. There were no paroxysms, but there was some pain in the back. The rigidity had considerably diminished, and the lower jaw was slightly more movable. As the bowels remained inactive, an aperient was given. Food was well taken. A tonic was prescribed. From this time the patient made a steady and uninterrupted recovery, and, after a month at Scarborough, returned in perfect health.

CARBONIC ACID.—This gas was formerly thought to have a remedial action when inhaled in cases of *nasal catarrh*. In 1864 Herpin said of it: "Douches or injections of carbonic-acid gas have been successfully used in certain affections of the pituitary membrane; in cases of suppuration it corrects and diminishes the bad odour, and it favours and hastens recovery." M. Joal (*Revue internationale de rhinologie, d'otologie, et de laryngologie*, May, 1896), who quotes this passage from Herpin, reports two cases of *anosmia* cured by the use of the gas in the form of a nasal douche, and mentions its favourable action in *hypertrophic rhinitis* and *acute coryza*. He describes a simple device for the inhalation. An ordinary "siphon" of carbonic-acid water is turned upside down and the valve pressed in order to allow that portion of the liquid which is above the extremity of the tube to run out. On the tip of the outlet is placed a rubber tube about six inches in length, on the end of which a nasal cannula is attached, and the apparatus is ready for use. The cannula is introduced into the nostril and the valve pressed gently, and the carbonic acid penetrates the nasal fossæ; or the valve may be

brought near the nostril so that the patient may inhale the gas, and in this way it is drawn through the respiratory and olfactory parts of the nasal passages.

CARDOL.—Under this name two oily liquids are on the market—one obtained from *Anacardium occidentale*, which is a *vesicant;* and the other from *Anacardium orientale*, which is a *rubefacient.*

CARNIFERRIN.—According to Professor Coblentz, this German meat preparation contains 30 per cent. of iron in combination with phosphoric acid. It is said to be tasteless. It may be given to children in doses of from 3 to 5 grains, and to adults in doses of 8 grains, as a *tonic* and *nutrient.*

CELLOIDIN.—Dr. R. T. Williamson (*British Medical Journal*, April 18, 1896) thinks that a solution of celloidin is superior to collodion in adhesive power. He says the strength of the solution he has employed has been the same as that used in microscopical work—namely, 2 parts of celloidin dissolved in a mixture of 15 parts of absolute alcohol and 15 parts of pure ether (specific gravity, 0·720). It is important, he says, to use pure absolute ether of this specific gravity, and not the sulphuric ether which has a specific gravity of 0·735. If the latter is used the celloidin does not adhere to the skin so well.

CELLULOID.—Professor Landerer and Dr. E. Kirsch (*Centralblatt für Chirurgie*, July 18, 1896; *New York Medical Journal*, August 1, 1896), after mentioning the great drawbacks of plaster of Paris as a *splint material*—its weight and its proneness to become foul by absorbing sweat, urine, etc.—say that in the Medico-mechanical Institute of Stuttgart celluloid has been found an excellent substitute free from these disadvantages. A wide-mouthed bottle is packed for about a quarter of its height with celluloid cut into small pieces, and then it is filled with acetone. It is provided with an air-tight stopper to guard against evaporation. From time to time it is opened, and the contents are stirred with a stick. The celluloid dissolves in course of time. A plaster cast of the diseased or injured part is covered with a moderately thick layer of felt or flannel, and the celluloid solution is rubbed into this covering with the hands, which are to be protected with leather gloves. This process should be repeated from four to six times. The advantages of the celluloid splints and corsets are their lightness, hardness, stability, elasticity, and cleanliness.

CHELIDONIUM.—A Russian physician, Dr. Denissenko (*Vratch*, 1896, No. 30: *Deutsche Medizinal-Zeitung*, September 24, 1896; *New York Medical Journal*, October 10, 1896), has tested the action of the juice of *Chelidonium majus* on *cancer* in the municipal hospital in Brjansk. In his early experiments he used the fresh juice of the herb, but since February, 1895, he has been using the extract found in the shops.

His method of employing chelidonium is as follows: He directs that from 22 to 75 grains of the extract be taken internally, dissolved in distilled water or peppermint water, every day throughout the treatment. Into the substance of the tumour, as close as possible to the boundary between it and the healthy tissue, he throws a number of injections of from 2 to 4 drops of a mixture of equal weights of the extract, glycerin, and distilled water, not exceeding a Pravaz's syringeful in all. The frequency with which these injections are given is not stated. If the tumour is ulcerated, he paints its surface twice a day with a mixture of 1 or 2 parts of the extract and 1 part of glycerin. Iron, quinine, and other supporting remedies are employed according to the indications.

Except in a few cases, he says, the internal use of the drug caused no disturbance of the stomach, but the painting of the ulcerated surfaces gave rise to a slight and transitory burning. It was different with the parenchymatous injections; in all instances, after the injections, especially after the first one, there was burning pain at the site of the operation, the patient felt weak, there was a more or less severe chill, and then the temperature rose to between 100° and 102° F. Although these symptoms disappeared on the following day, Dr. Denissenko saw reason to exercise a certain amount of caution in the use of the injections.

The effects of this treatment were shown in the course of a few days. They were the following: 1. The sallow hue of the skin disappeared. 2. Softening of the tumour set in. 3. After from three to five days there formed at the points of injection fistulous tracts about which the softening process went on with special rapidity. 4. In from fifteen to twenty days a line of demarcation could be distinguished between the morbid and the healthy tissues; the one seemed to be forced away from the other. In general, the tumour diminished more than half in circumference, and the affected lymphatic glands of the neighbourhood underwent involution.

CHLORALIMIDE.—This substance, $CCl_3CH:NH$, must not be confounded with *chloralamide.* Chloralimide is a crystalline powder obtained by the action of heat on chloral ammonium. It is *hypnotic* and *analgetic.* The dose is from 15 to 45 grains, and not more than 90 grains should be given in twenty-four hours. Clinical data concerning its use are still so defective as to call for caution in its employment.

CHLOROSALOL.—See under SALICYLIC ACID AND THE SALICYLATES (Supplement).

CHOCOLATE.—See under COCOA.

CITROPHEN, a compound of citric acid and paraphenetidine, $C_6H_4OH\left(\begin{matrix}CONH\\OC_2H_5\end{matrix}>C_6H_4\right)_3$, is closely allied to apolysine (*q. v.*). It is employed as an *antipyretic* and *analgetic* in doses of from 7 to 15 grains.

COCAINE.—The *Therapeutische Wochenschrift* for June 21, 1896, contained an interesting summary of several cases of *poisoning with cocaine*, the substance of which is given in the *New York Medical Journal* for July 11, 1896. The writer first remarks upon the extraordinary variability of the symptoms in

cases of cocaine poisoning. There may, he says, be intellectual torpor, tonic or clonic convulsions, or maniacal exaltation. Respiratory disturbances are particularly intense; the breathing is shallow, in severe cases it may be of the Cheyne-Stokes type, and death may occur from respiratory paralysis. Phenomena pertaining to the circulation are less pronounced. Poisoning has been known to follow the use of so small an amount of cocaine as 0·077 of a grain, and in many cases that have been reported there has been no reason to suppose that the preparation was impure or that the recognised maximum dose was exceeded; idiosyncrasy must therefore be assumed to have taken a part in giving rise to the results.

After making these remarks, the writer proceeds to give condensed accounts of four cases of cocaine poisoning. The first and second cases were reported by Dr. M. Weinrich in the *Berliner klinische Wochenschrift*. In one of them the patient, who had a tumour of the bladder, had been examined with the cystoscope several times and operated upon with the aid of that instrument and the use of a one-to-fifteen solution of cocaine. On the third day after the operation the same solution was injected, and immediately signs of poisoning showed themselves—unconsciousness, epileptoid convulsions, Cheyne-Stokes respiration, and slowing of the pulse, which was imperceptible in the wrist and hardly to be felt in the thigh. The patient was saved by means of prolonged and energetic artificial respiration. A week later there was occasion to use an injection of half the strength of the preceding ones, and no signs of poisoning showed themselves. Dr. Weinrich's other patient was a man eighty years old. Similar phenomena of poisoning were observed after a urethral injection of a one-to-fifteen solution of cocaine.

The first case is remarkable, says the *Therapeutische Wochenschrift*, from the fact that the cocaine had been used six times without any ill effect, and then on the seventh occasion, without there being any condition especially favourable to absorption, severe poisoning resulted. It seems that the mucous membrane of the urethra absorbs drugs more readily than that of the bladder, the writer goes on to say, but it may be assumed that the vesical mucosa absorbs them more readily when it is diseased than when it is healthy, on account of losses of epithelium, etc.

The third case was reported by Dr. E. Pfister, of Cairo, in the *Berliner klinische Wochenschrift*, 1896, No. 14. The man had suffered with retention of urine a number of times in consequence of vesical calculi. He received an injection of a 20-per-cent. solution of cocaine into the bladder, and died almost immediately. A Pravaz's syringe, the writer remarks, will hold four times the amount of such a solution as would contain the maximum dose of cocaine, and it is probable that in this case a still larger syringe was used, for only thus, he says, can the lightninglike rapidity with which the drug acted be explained.

The fourth case was observed by Dr. G. Duchesne, of Orbec, and reported in the *Année médicale de Caen* for 1896. A man thirty-eight years old had two injections of cocaine into the gum, in order to have a tooth extracted without pain. On the following day he had œdema of the lids of each eye, especially of the upper lid, which increased for forty-eight hours and then subsided entirely. Repeated examinations of his urine showed no trace of albumin. In this case, the writer in the *Therapeutische Wochenschrift* thinks, there was probably a vaso-motor paralysis in consequence of the action of the drug on the terminations of the inferior dental nerve, which is a branch of the inferior maxillary, or of a part of the trigeminal, which by its ophthalmic branch of Willis is in close connection with the skin and the mucous membrane of the lids.

Great caution must be observed in the use of cocaine within the urinary passages, says the writer, but he adds that the capricious action of the drug is as difficult to guard against as that of chloroform. The use of cocaine is contra-indicated in anæmic persons and in those that are the subjects of respiratory or circulatory disease. When cocaine poisoning occurs, amyl nitrite and chloroform should be used, also opium and chloral hydrate for the convulsions, but above all artificial respiration and injections of camphor dissolved in ether.

CODEINE.—According to Mr. Joseph W. England (*American Journal of Pharmacy*, July, 1894), a mixture for *coughs*, known as the "C.—C." cough mixture, is very largely used in the Philadelphia Hospital. The formula is as follows:

℞ Codeine sulphate.....		1 grain;
Diluted hydrocyanic acid..		16 minims;
Chloroform,	each..	2 fl. drachms;
Mucilage of acacia,		
Syrup of wild cherry to....		1 fl. oz.

M. Dose, a teaspoonful.

A somewhat similar formula is given on page 286 of vol. i.

CODOL.—See ROSINOL.

COPAIBA has been recommended by Professor Monti, of Vienna, in the treatment of *scabies* in children. Waring (*Manual of Practical Therapeutics*, Philadelphia, 1886) states that Dr. Monti employed the balsam in twenty-seven instances, and in each case effected a complete cure. Each child was first washed with soap and water and then rubbed all over twice daily with the balsam. No other application was used. He found that the itch insect could not live in the balsam beyond two or three hours.

COTARNINE HYDROCHLORIDE.—See STYPTICIN.

COTTON ROOT.—Dr. George A. Blakeley, of Albany, Wisconsin (*Medical News*, April 11, 1896), reports a case of *poisoning with cotton root*. A woman, supposing herself to be pregnant, took 4 oz. of the fluid extract during the interval from 9 to 10 P.M. At about 11 o'clock her husband arrived home and found her unconscious. He summoned Dr. Blakeley, who

soon reached her and found her in a state of complete muscular relaxation. The pupils were both widely dilated; the respiration was 10, sighing and shallow; the pulse was 150, very weak and compressible; and the temperature was 95° F. in the axilla. There was a faint, peculiar odour to the breath, but there were no blisters on the lips or tongue, though the latter was very dark coloured. Dr. Blakeley gave ¼ of a grain of apomorphine hypodermically and diluted alcohol by the same method. Thorough emesis occurred in five minutes, and the vomited matter was reddish-brown. The symptoms showed rapid improvement, and in half an hour she could swallow, when the stomach was thoroughly washed out, getting rid of some more reddish-brown material, which appeared like extract of cotton-root bark. In about two hours she was able to talk. She improved rapidly and the next morning was able to sit up. No further trouble occurred except that she was quite weak for a few days. It turned out that she was not pregnant.

CREOSAL.—This is described as a dark-brown hygroscopic powder, readily soluble in water, made by heating beechwood creosote with tannic acid and phosphorus oxychloride. It has been recommended in the treatment of *catarrh of the respiratory organs*, in doses of 15 grains three time a day.

CREOSOL.—This is an oily liquid, called also *homoguaiacol* and *homopyrocatechinmethyl ether*, $C_6H_3.CH_3(OCH_3).(OH)$, obtained by distilling beechwood tar or gum guaiacum (Merck). It has been recommended as an *antiseptic*.

CREOSOTE.—Dr. J. P. West, of Bellaire, Ohio (*Archives of Pædiatrics*, May, 1896), records the cases of two children with *enlarged bronchial glands* in which the beneficial effect of creosote was very prompt and decided.

CREOSOTE-CALCIUM CHLORHYDROPHOSPHATE.—This is described as a white syrupy mass consisting of creosote carbonate and calcium chlorhydrophosphate. It has been recommended in the treatment of *tuberculosis* and *scrofula* in doses of from 3 to 8 grains, in an emulsion, twice a day. Professor Coblentz gives the following formula:

℞ Creosote-calcium chlorhydrophosphate	5 to 10	parts;
Mucilage of chondrus	15	"
Oil of sweet almonds, } each.	25	"
Syrup of Tolu, }		
Orange-flower water	75	"

M. Dose, a teaspoonful twice a day.

CRESALOL, CRESOL SALICYLATE.—See under SALICYLIC ACID AND THE SALICYLATES (Supplement).

CRYOSTASE.—This is the name of an *antiseptic* preparation said by Professor Coblentz to be a mixture of equal parts of carbolic acid, camphor, and saponin, with traces of oil of turpentine.

CUTAL.—See ALUMINUM BOROTANNICOTARTRATE (Supplement).

DERMATIN.—According to Professor Coblentz, this is a mixture of from 5 to 7 parts of salicylic acid, from 7 to 15 parts of starch, from 25 to 50 parts of talc, from 30 to 60 parts of silicic acid, and from 3 to 9 parts of kaolin, used as a protective to the skin.

DESOXYALIZARIN.—See ANTHRAROBIN.

DEXTROSE.—See under SUGAR (vol. ii, page 235).

DIABETIN.—See LEVULOSE.

DIACETANILIDE.—This compound, $C_6H_5N(C_2H_3O_2)_2$, is made by heating acetanilide with glacial acetic acid. It is said to be similar to acetanilide in its action, but more powerful.

DIACETYLTANNIN.—See TANNIGEN.

DIETHYLENEDIAMINE.—See PIPERAZINE.

DIETHYLSULPHONEDIETHYLMETHANE.—See TETRONAL.

DIETHYLSULPHONEDIMETHYLMETHANE.—See SULPHONAL.

DIETHYLSULPHONEMETHYLETHYLMETHANE.—See TRIONAL.

DIMETHYLETHYLCARBINOL.—See AMYLENE HYDRATE.

DIOXYANTHRANOL.—See ANTHRAROBIN.

DISPERMINE.—See PIPERAZINE.

DITHYMOL IODIDE.—See ARISTOL.

DITHYMOL TRIIODIDE.—See ANNIDALIN.

DUOTAL.—Guaiacol carbonate (see under GUAIACOL).

EMBELIC ACID.—See under EMBELIA RIBES.

ERODIUM CICUTARIUM.—This geraniaceous plant, the hemlock stork's-bill, wild mush, or pine grass, has been used as an *astringent* and *diuretic*. Dr. Komarovitch (*Vratch*, February 29, 1896; *Lancet*, April 4, 1896) states that he has made considerable use of it in *uterine hæmorrhage* with excellent results, often after better-known drugs, such as ergot and hydrastis, had failed. He believes that the effect of the erodium is to increase the elasticity of the muscular fibres and thus to favour their contraction. In one case where a polypus was the cause of the hæmorrhage, after a fortnight's treatment the tumour was extruded into the vagina, which had never occurred with other drugs previously tried. Twenty of the cases where erodium succeeded after the failure of ergot and hydrastis were due to metritis, but others were dependent on myoma and abortion. The preparation used was an infusion made with 12 parts of water to 1 part of the plant, to which a little peppermint was added to improve the taste. Of this a tablespoonful was prescribed every two hours. In no case were any unpleasant by-effects produced, though sometimes the use of the medi-

cine was continued for some weeks. The active principles of the plant are stated to be "an ethereal oil, a bitter principle called geramin, and tannic acid."

ETHYL CARBAMATE.—See URETHANE.

ETHYL CHLORIDE.—In addition to its use as an anæsthetic, ethyl chloride is often of service as an *analgetic*. The spray may be applied repeatedly to the painful part, which it may not be necessary to freeze. Dr. W. C. Daisch, of Melbourne (*Australian Medical Journal*, December 20, 1895), has found it to give great relief in such forms of *pain* as that of *migraine*, the *headache of influenza*, and *toothache*. It will relieve the pain of *iritis* or *conjunctivitis* if sprayed round the orbit. In *epididymitis* it relieves and reduces inflammation, and it has been used in *meningitis* and *sunstroke*. *Itching*, *pleurodynia*, and the *pain of shingles* may be relieved by its use. In *spasmodic dyspnœa*, *asthma*, and *hiccough* it should be sprayed round the base of the chest, says Dr. Daisch, who adds that it will stop *epistaxis* if applied to the base of the nose, or sprayed directly into the nostrils, and might be advantageously used in *persistent bleeding after tooth extraction*.

According to Dr. Daisch, ethyl chloride is very serviceable as a *dental anæsthetic*. Before it is applied, he says, the gum should be thoroughly dried and smeared with vaseline, and the neighbouring parts protected by packing with wool. The patient is instructed to breathe through the nose. During thawing, care must be observed in the use of hot water; if it is used too hot or too soon, sloughing may result. For the extraction of a tooth the gum may be frozen on each side of the tooth; it checks *bleeding* in addition to its action as an anæsthetic. It is said not to be necessary to spray into the mouth at all to prevent pain in extractions. If the jet is thrown on to the jaw outside, near the entrance of the dental nerve in front of the ear for the upper, behind the ramus of the inferior maxilla for the lower jaw, anæsthesia of the whole jaw on one side will be caused, and teeth may be extracted painlessly, says Dr. Daisch; he remarks that this is useful in the case of molars, which are not so accessible to the spray as the front teeth.

ETHYLENE PERIODIDE.—See DIIODOFORM.

ETHYLURETHANE.—See URETHANE.

EUCAINE, $C_{19}H_{27}NO_4$, is the methyl ester of a benzoylated oxypiperidinecarbonic acid. The hydrochloride obtained by crystallization from a methyl-alcohol solution bears the formula $C_{19}H_{27}NO_4.HCl.HO_2$. Eucaine is insoluble in water, but dissolves freely in alcohol, in ether, in chloroform, and in benzene. Evaporated from its ethereal solution, it appears in large, brilliant, colourless crystals, which melt at 219° F. It combines with mineral acids to form more or less freely soluble salts, also crystalline in character. Eucaine hydrochloride occurs in the form of brilliant platelets or crystals which dissolve readily in six parts of water at the temperature of the room. There are some points of chemical similarity and difference between the hydrochloride of cocaine and that of eucaine. Both, in solution, change in colour to yellow and orange-red when boiled with ferric chloride. The addition of a 5-per-cent. solution of chromic acid to a solution of eucaine gives rise to a beautiful yellow, crystalline precipitate. With cocaine it does not. Again, a solution of the eucaine salt, treated with a 10-per-cent. solution of potassium iodide, presents at first a milky turbidity, and gradually deposits fine colourless plates after standing. In this respect it differs from cocaine. The hydrochloride of eucaine is stable in the air, and it does not undergo decomposition or change, as cocaine does, when subjected to boiling. Cocaine, as is well known, splits up into benzoylecgonin and methyl alcohol, which renders its subsequent use upon mucous membranes irritating. Solutions of eucaine salts remain clear, moreover, and require, therefore, no preservative agent to be added.

Dr. Gaetano Vinci, of Messina, as a result of clinical and laboratory experiments, finds (*Therapeutische Monatshefte*, June, 1896) that a solution of eucaine hydrochloride of a strength of from 2 to 5 per cent. induces prompt anæsthesia of the conjunctiva and cornea in from one to three minutes. The anæsthesia lasts from twenty to thirty minutes and may be prolonged by the further application of the solution. The pupil does not become dilated, and during the local anæsthesia reacts normally to light. Irritation of the conjunctiva is almost always absent, but the observer reports an occasional hyperæmia following the use of cocaine.

The effect of large or medium doses upon animals is a general excitation of the central nervous system, followed ultimately by paralysis. Severe tonic and clonic convulsions sometimes appear, which are succeeded by paralysis. Some central irritation of the vagus nerve diminishes the frequency of the heart's beats, and because of the irritation of the vasomotor system of nerves the blood-pressure rises. In Vinci's experiments, only fatal doses succeeded in giving rise to a sudden diminution of the blood-pressure. When doses of from $\frac{1}{3}$ to $\frac{1}{4}$ of a grain for each thirty-five ounces of the animal's weight are given, coma, dyspnœa, and opisthotonos, with paresis of the posterior limbs, supervene. Fatal doses kill by respiratory failure after a preliminary hastening of the respiration with marked dyspnœa. In man, toxic symptoms have never been evoked, and if it is given in therapeutic doses—according to Kiesel as much as 30 grains—no bad effects upon the heart or respiration are likely to follow.

Vinci points out the similarity of the physiological action of eucaine and that of cocaine, with their differences. Eucaine is distinctly less poisonous to man than cocaine, and of animals injected with the same quantities of both drugs, those treated with eucaine survived, those with cocaine died. Eucaine produces a primary decrease in the frequency of the heart's action; cocaine an acceleration. So

far as their *anæsthetic* properties are concerned, the two drugs are very similar, except that eucaine possesses the advantage that it favours hyperæmia, while cocaine induces ischæmia. Upon the eye, eucaine does not cause mydriasis, and it does not interfere with the reaction of the pupil to light, an advantage of importance in ophthalmological operations.

Upon the mucous membranes of the nose and throat eucaine produces a strong anæsthetic influence, with no bad effect upon the heart. Kiesel obtained good results in dental work with solutions of the hydrochloride of a strength of from 1 to 5 per cent. Schleich has found that, in the same strength, it produces a strong anæsthetic influence when subcutaneously administered; for *infiltration anæsthesia*—as first advocated by Schleich—a solution of the strength of from 1 to 2 per cent. is sufficiently strong. He believes that eucaine will replace cocaine in instances where its simple application upon mucous membranes is required.

In ophthalmological practice many other workers have substantiated Vinci's work. Carter, of London (*Lancet*, July 11, 1896), highly recommends eucaine hydrochloride as being less toxic than cocaine and as having no mydriatic effect, two advantages which appeal to him strongly. In cases in which a contraction of the smaller vessels is desired, however, cocaine had better be employed. Vollert (*Münchener medicinische Wochenschrift*, 1896, No. 22) has seen occasional hyperæmia follow the local use of eucaine in the eye, as was, however, stated in Vinci's original paper (*Deutsche Medizinal-Zeitung*, April 27, 1896). Anæsthesia of mucous membranes follows the instillation of eucaine hydrochloride in from one to three minutes, and lasts, according to different observers, from ten to thirty minutes.

Görl (*Therapeutische Monatshefte*, July, 1896) has used eucaine as an anæsthetic for cystoscopic work, and says that patients complain at first of some irritation and burning, but that the anæsthesia is as profound as that of cocaine. He used a 0·5-per-cent. solution. Cystoscopy is succeeded by a slight bleeding, which he attributes to a hyperæmia induced by the eucaine. He finds that eight cubic centimetres of the same solution occasion some burning in the urethea, but this is followed by an anæsthesia sufficiently strong for the manipulation of instruments. Görl has also found the agent satisfactory in laryngological work.

It has been suggested that in order to avoid the smarting sometimes incident to the use of eucaine on mucous membranes, a 1-per-cent. solution should be first instilled, and this followed in from two to three minutes by the instillation of a 2-per-cent. solution. In order to overcome the ischæmia produced by cocaine, Berger has proposed this formula for the purposes of local anæsthesia:

℞ Eucaine hydrochloride, } each. 3 grains;
Cocaine hydrochloride, }
Distilled water ..... 300 minims.
M.

For the other requirements of local anæsthesia, eucaine seems to be the equal of cocaine in rapidity, in intensity, and in duration. It may be employed for subcutaneous anæsthesia in any part of the body in strengths of from 1 to 6 or 7 per cent. for the *opening of abscesses*, the *removal of small tumours* or *growths* of any kind, or for the general purposes of minor surgery, with perfect safety. The writer has recently used, subcutaneously, a 6-per-cent. solution for the extirpation of a very large wart, and perfect anæsthesia was procured. It lasted twenty minutes and allowed of extensive suturing. An additional virtue of the hydrochloride of eucaine rests upon the fact that it is not decomposed by repeated boiling, and may thus be sterilized as often as desired.

The dose of eucaine is the same as that of cocaine. As mentioned above, Kiesel (*Zahnärztliche Rundschau*, April 5, 1896; *New York Medical Journal*, May 9, 1896) says that 30 grains may be employed safely by subcutaneous or submucous injection.

SAMUEL M. BRICKNER.

EUCALYPTUS.—In the *British Medical Journal* for August 29, 1896, there is an abstract from an Italian journal of an article by Dr. Monfrida Musmeci, who, while studying the action of eucalyptus, found that a decoction of the leaves and a solution of a salt of strychnine formed a flocculent precipitate of a clear colour, while there remained above a solution of citron-yellow tint, the strychnine at the same time losing completely its characteristic bitter taste. On this account the author raised the questions of whether the strychnine lost its toxic action, and if accordingly eucalyptus could be used as an antidote. To ascertain, he carried out a series of experiments on frogs, rabbits, and dogs. He found that a solution of nitrate of strychnine, 1 per cent., when injected with a Pravaz syringe, would kill a frog in from eight to ten minutes after a dose of 0·001 of a gramme, while a dog was killed in thirty-nine minutes by a dose of 0·001 of a gramme for each kilogramme of its weight. When a decoction of eucalyptus was administered at the same time the animal survived the same dose used for the check experiment, and even became tolerant of a much larger dose. In other experiments the eucalyptus was administered after convulsions had appeared, and then these became much less marked and even disappeared. From these experiments Musmeci believes that eucalyptus has a true antidotal action in *strychnine poisoning*, and recommends that practical application should be made of it by using a decoction for washing out the stomach in such cases.

EUCASIN.—This is a German nutrient preparation made by subjecting the casein of milk to the action of ammonia. Dr. A. Cohn (*Centralblatt für innere Medicin*, July 11, 1896; *New York Medical Journal*, August 1, 1896) describes it as a white powder of a somewhat gritty aspect, without any special taste, and having a faint odour of milk. Mixed with cold water, it forms a gelatinous mass. On shaking it with boiling water, a uniform clear-white solution is formed. This tastes like groats, but is more glutinous.

He has used it in the form of a mush of oatmeal or rice, to each plateful of which a teaspoonful of eucasin has been added, together with a little salt. This mixture is readily taken two or three times a day. A chocolate preparation containing 20 per cent. of eucasin has been put on the market by Hartwig & Vogel, of Dresden. Dr. Cohn gives brief accounts of several cases in which he has found eucasin of advantage, including cases of *pulmonary* and *laryngeal tuberculous disease*, *anæmia*, *peritoneal irritation*, *typhlitis*, *parametritis*, and *perimetritis*. Particularly striking were the effects of its employment in a case of acute anæmia following abortion.

Dr. E. Salkowsky (*Deutsche medicinische Wochenschrift*, April 9, 1896; *Therapeutische Wochenschrift*, April 19, 1896) thinks that one of the advantages of eucasin is that it contains no nuclein, so that it is well fitted as an article of diet for persons of the *uric-acid diathesis* and predisposed to *gout*.

EUDOXINE.—This is a nosophene compound said by Professor Coblentz to contain 52·9 per cent. of iodine and 14·5 per cent. of bismuth. It is described as a reddish-brown powder, odourless and tasteless, employed as a *gastric* and *intestinal antiseptic*. From 3 to 6 grains may be given to an adult three times a day (*Presse médicale belge*, August 11, 1895; *Revue illustrée de polytechnique médicale*, October 31, 1895).

EUQUININE.—This substance is described by von Noorden (*Centralblatt für innere Medicin*, November 28, 1896; *New York Medical Journal*, January 2, 1897) as the ethylcarbonic-acid ester of quinine, having the constitutional formula $CO < \begin{matrix} OC_2H_5 \\ OC_{20}H_{22}N_2O \end{matrix}$. It occurs in white needles which are soluble with difficulty in water, but readily soluble in alcohol, in ether, and in chloroform. It has an alkaline reaction and forms crystalline salts with acids. The chloride is readily soluble in water, the sulphate dissolves with some difficulty, and the tannate is almost insoluble.

The alkaloid itself, which is the form in which von Noorden has used euquinine most largely is entirely tasteless at first, but has a slightly bitter after-taste, reminding one of the taste of a very weak solution of quinine. If it is taken in sherry, milk, soup, cocoa, or the like, he says, no unpleasant taste is perceived. Healthy persons can take 15 grains, and in most instances twice that amount, daily without experiencing any unpleasant feeling in the head. Even after a prolonged use of these doses there were no disturbances attributable to them in any of von Noorden's patients.

Euquinine is said to be a derivative of quinine, of which it has the characteristic remedial virtues without any of the unpleasant properties of that drug. This is implied in its name. It may be used in all cases in which quinine is indicated, but for any reason is objectionable.

EURYTHROL.—See SPLENIC EXTRACT.

EXERCISE.—For the Schott method of treating chronic heart disease, see under BATHS (Supplement).

FILMOGEN.—This fanciful name has been applied to an English preparation, apparently proprietary. According to the *British Medical Journal* for December 19, 1896, it consists of a solution of pyroxylin in acetone, and in order to render flexible the film of nitrated cellulose left after evaporation of the acetone, a small quantity of oil is added. The solution possesses considerable solvent powers upon many drugs employed in dermatological practice, such as salicylic acid, resorcin, iodoform, pyrogallic acid, mercury bichloride, chrysarobin, cocaine, ichthyol, and carbolic acid. Its viscosity permits of the easy suspension of such insoluble substances as sulphur, lead acetate, zinc oxide, etc. Filmogen, when painted on the skin, quickly forms a film, which adheres firmly, is flexible, and is unaffected by washing with water; the film can be removed easily by means of alcohol.

FORMALDEHYDE.—Dr. Elmer Grant Horton, of the laboratory of hygiene of the University of Pennsylvania (*Medical News*, August 8, 1896), has experimented with formaldehyde as a means of *disinfecting books*. His conclusions are as follows:

1. Books can be disinfected in a closed space simply by vapour of commercial formalin by using 1 cubic centimetre of formalin to 300 cubic centimetres, or less, of air. 2. The vapour of formalin is rapid in its disinfecting action. The effect produced in the first fifteen minutes is practically equivalent to that observed after twenty-four hours. 3. An increase in the amount of air to each cubic centimetre of formalin is not counterbalanced by an increase in the length of time of exposure. 4. In case the disinfection has been incomplete, the vitality of the organisms has been so weakened that they survive only if transferred in a few hours to media suitable for their development. 5. The use of vapour of formalin has not been found detrimental to the books, and it is not objectionable to the operator beyond causing a temporary irritation of the nose and eyes, somewhat similar to that produced by ammonia.

Dr. J. N. Hurty, of Indianapolis (*Indiana Medical Journal*, December, 1896), speaks of a lamp invented by Professor F. C. Robinson, of Bowdoin College, as probably the best formaldehyde lamp thus far devised.

Dr. W. S. Alexander, of Oxford, Ohio (*New York Medical Journal*, January 9, 1897), reports having cured a rebellious case of *pruritus vulvæ* with formaldehyde. He says also that cases of *whooping-cough* are treated successfully by spraying with an atomizer three times daily for fifteen minutes at a time, using a 1-per-cent. solution. He speaks of formaldehyde as surpassing all other remedies in the treatment of *hay-fever*—spraying with a half-per-cent. solution and directing the pa-

tient to inhale the fumes of a 2-per-cent. solution.

FORMALOSE.—See FORMALDEHYDE.

FORMOGELATIN is stated (*British Medical Journal*, December 19, 1886) to be a compound of formaldehyde and gelatin. It is a gray, somewhat gritty, mobile, and odourless powder, intended to be used in the dressing of wounds as a substitute for iodoform. It is said to be a convenient preparation of formaldehyde in a dry form. Cf. GLUTOL.

FORMYL CHLORIDE.—See CHLOROFORM.

FORMYL TRIBROMIDE.—See BROMOFORM.

FORMYL TRIIODIDE.—See IODOFORM.

FRAXININ.—See under MANNA.

GADUOL.—See MORRHUOL.

GALACTOSE.—See under SUGAR (vol. ii, page 235).

GALACTOTHERAPY.—See under SERUM TREATMENT (vol. ii, page 187).

GARGLES.—In a paper read before the British Laryngological, Rhinological, and Otological Association, Mr. Lennox Browne (*Journal of Laryngology, Rhinology, and Otology*, March, 1896; *New York Medical Journal*, March 21, 1896) argued in favour of abolishing gargling in the treatment of diseases of the throat by general practitioners. He said that for the purpose of laving the posterior pillars and wall of the pharynx von Tröltsch's method must be used. The following were the directions: "Take a portion—say a tablespoonful—of the gargle in the mouth, hold it in the back of the throat with the head thrown back; then, closing the nose with the finger and thumb to prevent entrance of air, open the mouth and make the movements of swallowing without letting the liquid go down the throat."

But this process, says Mr. Browne, is by no means easy to carry out efficiently, and is impossible when any acute inflammation of the throat is present, on account of the pain caused by the necessary muscular action. The muscular acts required for ordinary gargling are entirely irregular, he adds, being unlike those called for in the exercise of the normal functions, such as breathing, speaking, swallowing, or even laughing. In all cases, therefore, of acute inflammatory disease of the throat in which the act of swallowing causes severe pain, and even movements of the tongue are attended with discomfort, and in cases (such as those of amygdalitis) in which the mouth can be opened but very slightly, the act of gargling by any method can not but tend to increase the inflammation and the patient's distress.

Gargles are also contra-indicated, says Mr. Browne, in cases where the patient requires to be kept in the recumbent posture in bed—notably in cases of diphtheria, in which cardiac failure has to be especially guarded against—since the act requires him to rise from that position. And as, according to the well-known law, paralytic sequelæ attack earliest and to the greatest extent muscles in proportion to the constancy of their use, palatal and faucial paralyses, early and frequent as they always are, can not but be accentuated by the irregular and excessive functional exercise involved in the act of gargling.

Lastly, gargles, however employed, whether by the ordinary method or by von Tröltsch's, he says, can not be safely prescribed unless the ingredients are harmless should any portion be inadvertently swallowed. All these objections to gargles in the adult apply with still greater force, he adds, in the case of children, in whom the act of gargling is in the majority of cases simply impossible. Gargles, therefore, should be employed only as emollient and antiseptic mouth washes, harmless ingredients being used. As a substitute Mr. Browne would recommend the more general use of mouth irrigations, sprays, lozenges, and, in the case of children, medicated confections.

In the discussion that followed, Dr. Dundas Grant said that there was one aspect of the gargling question which he thought would come up, to which we might attach at least a theoretical and also a practical value, which was that, in practising von Tröltsch's method, it was not altogether useless as a method of massage, and there was a school in which massage of the throat was given a prominence which he thought was quite unnecessary, but still not to be despised. He stated that he had seen some advantage from the employment of massage of the outside of the pharynx; possibly, also, the Eustachian tubes might be improved by the patient's practising von Tröltsch's method of gargling at the same time. The swallowing part of it was, he said, the most essential feature, and he thought that in subacute cases where a degree of congestion and thickening remained we might yet find it of some use, although it might be limited.

GELANTH, GELANTHUM.—See under VARNISHES.

GEOSOTE.—This substance is described by Dr. Rieck, of Bassum (*Deutsche Medizinal-Zeitung*, December 24, 1896; *New York Medical Journal*, January 23, 1897), as the valerianic-acid ester of guaiacol, a yellowish, oily liquid of the specific gravity of 1·037, but slightly soluble in water, but readily soluble in acid and alkaline liquids, in alcohol, in ether, in benzene, and in chloroform. It has a sweetish and smoky odour and a sweetish taste passing into a slight bitter, unaccompanied by burning and not persistent. Applied to the skin and covered with gutta-percha tissue, it is rapidly absorbed and causes no irritation. Injected subcutaneously in amounts of from 15 to 30 grains, it causes transitory burning and does not give rise to general symptoms. If the injection is thrown into a diseased part, slight œdema with a sensation of heat may result and persist for a few days.

Geosote is given internally in 3-grain gelatin

capsules. It is said not to disturb the stomach in any way when given in daily amounts of from 15 to 45 grains and used continuously for months, and not to give rise to the eructations occasioned by creosote—that is, Dr. Rieck has known it to cause eructations in only one instance, and in that case there was gaseous distention of the stomach to begin with. He says he has given as much as 75 grains a day without giving rise to any unpleasant effects. He has found it useful in *chlorosis, acute gastric* and *intestinal catarrh, tuberculosis,* and *articular rheumatism.*

GLUCOSE.—See under SUGAR (vol. ii, page 235).

GLUSIDE.—See SACCHARIN.

GLUTOL.—This is a German proprietary preparation consisting of gelatin impregnated with formaldehyde. As at first prepared, it was a whitish powder insoluble in water; it is now furnished only in the granular, or "grated" form, which Dr. Schleich considers preferable to the powder. It is highly recommended as an *antiseptic* application to *wounds, ulcers,* and *weeping affections of the skin and mucous membranes.* Dr. C. L. Schleich, of Berlin, who introduced it into practice (*Therapeutische Monatshefte,* February, 1896), says that when it is in contact with living animal tissue the action of the cells of the tissue is to decompose the compound and set formaldehyde free. Glutol has been found to be particularly efficacious in sealing up *lacerated wounds,* even those communicating with a fracture. Probably glutol is substantially the same thing as formogelatin (*q. v.*).

GLYCERIN.—This familiar substance occasionally acts as a mild poison, even when used in small amounts. Antichievich (*Archiv für Kinderheilkunde,* xx; *Fortschritte der Medicin,* August 1, 1896) reports an instance of acute nephritis produced by it in the case of a boy who was being treated with injections of a solution of iodoform in glycerin. The nephritis disappeared after three weeks' use of a milk diet. In another case hæmoglobinuria came on after the second injection, and there was polyuria for eight days. Olive oil was substituted for the glycerin, and the injections were then well borne.

Glycerin is incompatible with potassium permanganate.

GLYCEROPHOSPHATES.—During the past two years a few articles have appeared in the Paris medical journals with regard to the use of the glycerophosphates of calcium, sodium, potassium, magnesium, and iron, which were first brought to the notice of the profession by M. Robin, in the *Bulletin de l'Académie de médecine de Paris,* April 24, 1894, and have since then been recommended by him as of great therapeutic value.

Cornet (*Progrès médical,* August 11, 1894) gives a description of the glycerophosphate of calcium and of the method of its preparation which may perhaps be taken as applying to the glycerophosphates in general. It is a white powder, slightly crystalline, soluble in fifteen parts of cold water, almost insoluble in boiling water, and insoluble in alcohol. The first step in its preparation is the manufacture of glycerophosphoric acid. A mixture of 3,600 grammes of pure glycerin and 3,000 grammes of phosphoric acid is maintained at a temperature of from 100° to 110° C. for six days, and thoroughly shaken three or four times each day. It gradually becomes darker in colour and gives off a vapour until, on the fifth day, it is brown and the vapour ceases to rise. After the sixth day the mixture is allowed to cool. It then becomes clear and transparent, and is known as glycerophosphoric acid. A solution of 500 grammes of calcium carbonate in 2 litres of water is now added very slowly to the acid and causes copious effervescence, from the formation of a large amount of carbon dioxide. This process is continued for two days, at the end of which time the preparation is filtered, neutralized with a weak solution of milk of lime, and precipitated by means of alcohol. This precipitate is gray in colour and resembles glycerole of starch. It is poured out at the end of an hour, redissolved in water, filtered, and evaporated at a low temperature.

Robin states that he has experimented with the salts of glycerophosphoric acid already mentioned, both singly and in combination, since 1888. He was induced to investigate their therapeutic action by the observations that a relatively large quantity of phosphorus in combination with organic substances could be found in the urine of certain patients, a condition which seemed to indicate an increased loss of the lecithin of the nervous system, and that most of the phosphorus in the nervous system was to be found in the form of glycerophosphoric acid, which is one of the constituents of lecithin. Another consideration which impelled him to the investigation was that drugs which contained phosphorus were assimilated with some difficulty, while an organic compound which resembled in form that present in the nervous system might be more acceptable and productive of greater benefit.

The physiological action of the glycerophosphates is said by Robin to be to accelerate metabolism and the nitrogenous exchanges, to favour the assimilation of albuminoid substances, and to increase the excretion of nitrogen, which tends to lower the proportion of uric acid to urea, though it does not influence the formation of uric acid to any extent. They increase the oxidation of broken-up sulphur products and the elimination of sodium chloride. Possibly they favour the assimilation of the phosphates in the food, and so afford a protective influence to the combined phosphorus in the nervous system.

The indication for the use of the glycerophosphates is a condition of nutrition frequently met with in many and diverse diseases, but not always present. This is a *diminution of nitrogen metabolism* or oxidation changes in the tissues, evidence of which may be found in an increased amount of phosphoric acid as compared with the urea in the urine. When this is absent, and particularly when the opposite condition, that of increased oxidation

changes, is present, the use of these remedies is contra-indicated. Hence one patient with a certain disease may be benefited and another harmed by the administration of these drugs. The best results are said to be obtained in *exhaustion of the nervous system*, as in *convalescence from acute diseases*, some forms of *neurasthenia*, and *muscular atrophy*. They have been used in *nervous asthma* from various causes—*chlorosis, gout, diabetes, phthisis pulmonalis, obesity, chronic nephritis, Addison's disease*, the *uric-acid diathesis, phosphaturia*, and *phosphaturic albuminuria*. They are said to be adequate to relieve the pain of *lumbago, sciatica*, and *trigeminal neuralgia*, and also the *lancinating pains of locomotor ataxia*. Lafage is inclined to think them of some efficacy as *galactagogues*.

The glycerophosphates may all be administered by the mouth, and the calcium, sodium, and magnesium salts may also be given hypodermically. For the latter purpose Robin recommends a 5-per-cent. solution of the calcium salt and a 20-per-cent. solution of the sodium salt. Of these, 3 or 4 minims may be injected daily. As the solutions are not of themselves antiseptic, but readily become contaminated, they should be freshly prepared, and the injections made with antiseptic precautions. Then they usually cause no local disturbance beyond some pain occasionally.

For the administration of glycerophosphates by the stomach Robin gives several formulæ, of which the following is one:

℞ Glycerophosphate of calcium.. 90 grains;
" of sodium, } each. 30 "
" of potassium, }
" of magnesium, }
" of iron..... 15 "
Tincture of St. Ignatius's bean. 30 drops;
Pepsin..... 45 grains;
Maltine..... 15 "
Tincture of kola..... 2½ drachms;
Syrup of cherries, sufficient to make 8 fl. oz.
M. Sig.: A tablespoonful at breakfast and dinner.

This syrup should be cherry-red. clear, and without deposit. The principal objections to it are that it is difficult to prepare and that it is very expensive. Moreover, M. Robin does not consider the commercial preparations of the glycerophosphates satisfactory.

[The following prescription is recommended by M. Delage (*Nouveaux remèdes*, April 24, 1896), who frequently substitutes it for the syrup:

℞ Glycerophosphate of calcium... 5 grains;
" " " magnesium 1·75 grain;
" " " iron..... 0·9 "
Powdered ignatia..... 0·5 "
Maltine..... 0·9 "
Pepsin..... 2·9 grains.
M. This quantity is for one capsule, and the dose is a capsule taken at breakfast and dinner.

M. Delage considers glycerophosphate of iron the best chalybeate that can be employed in the treatment of *chlorosis* and in *anæmia* with insufficiency of the oxidation of nitrogenous food. It is preferable, he says, to give it in the form of pills, as in the following formula:

℞ Glycerophosphate of iron... from 0·9 grain to 1·75 grain;
Powdered rhubarb..... 0·9 grain;
Extract of cinchona..... 2·9 grains.
M. This is for one pill; three such pills are to be taken during the day, one at each meal.]

MATTHIAS LANCKTON FOSTER.

GUAIACOCAINE.— Dr. W. J. Morton (*Dental Cosmos*, January, 1896) has given this name to a compound of 12 parts of guaiacol and 1 part of cocaine hydrochloride, which he has used successfully as a *local anæsthetic* by cataphoresis.

GUAIACOL has been praised by Tavitain in the treatment of *swelled testicle* (*Médecine moderne*, March 18, 1896). He applies it either pure, in amounts of from 30 to 45 grains, or in the form of an ointment, as follows:

℞ Guaiacol..... 5 parts;
Vaseline..... 30 "
M.

In mild cases, he asserts, three or four applications will suffice.

Dr. S. Solis-Cohen (*Philadelphia Polyclinic*, 1896, No. 16) says that guaiacol, used early in *diphtheria*, seems to have a germicidal effect and to prevent the spreading of the false membrane. Ten parts each of guaiacol and sterilized olive oil are used, with one part of menthol. In examinations of cultures after the application of this mixture no bacilli are met with where they had been found before. Prophylactically the mixture seems to be efficacious. In *follicular amygdalitis* it seems to cut short the course of the disease if applied early; and in *parenchymatous amygdalitis* it is said to mitigate the severity of the disease.

Dr. Maldaresco, of Bucharest, has used guaiacol in *pneumonia*, apparently with excellent results (cited in *Journal des praticiens*, March 28, 1896). He paints the drug over the posterior surface of the thorax corresponding to the area of pneumonic infiltration. In from six to seven hours the temperature sinks and, if the process is repeated three or four times daily, the temperature remains down. At the same time the cough diminishes, the tongue becomes moist and soft, the expectoration is more easily accomplished, and the sputum becomes more fluid. The temperature usually falls from two to three degrees, and sometimes not more than two applications are necessary to achieve this result. The author has never seen a relapse and has used no other drugs during this treatment. Maldaresco has obtained equally good results with the same procedure in *pulmonary gangrene* and *bronchopneumonia*. Should repeated applications irritate the skin, they may be made to the sides or to the anterior aspect of the thorax. The author uses a mixture of guaiacol and almond oil, the latter constituting 4 per cent. of the mixture. By this method of treatment he has had 83 recoveries and 18 deaths out of 101 patients.

The contention that guaiacol is an *anæs-*

thetic is not a new one. Laurens (*Annales des maladies de l'oreille*, xxii, 1896) has found that the drug, applied to the nasal and pharyngeal mucous membranes and to the ear in a 5-per-cent. solution in olive oil, produces local anæsthesia sufficient for the performance of minor operations. He applies it on probes armed with cotton and rubs the nose and pharynx with it briskly. Anæsthesia appears in from fifteen to twenty minutes. In the ear he places 5 or 6 drops of the same solution warmed slightly and allows it to remain about twenty minutes, when it is withdrawn by absorbent cotton. Paracentesis, says Laurens, may then be done painlessly.

Dr. J. Petrasko reports an abortion in a woman twenty-nine years of age, three months pregnant, who received ¼ of a grain of pure guaiacol twice daily in addition to an infusion of senega (cited in *New York Medical Journal*, June 27, 1896). The patient was suffering from an infiltration of the apex of the left lung. On the eighth day, after she had received in all 12 grains of guaiacol, abortion took place which could not be accounted for in any other way than as having been due to the influence of the drug. The reporter remarks that phenol and its derivatives exert a paralyzing action on the vaso-motor centres, so that they may cause abortion by inducing defective nutrition of the fœtus. It is added that the patient was of a nervous nature and may have had an idiosyncrasy for guaiacol.

[Dr. E. K. Morris, of Sturgeon Bay, Wisconsin (*Medical News*, January 9, 1897), reports having used guaiacol for *rhus poisoning* in two cases. The first patient was a man, forty-five years old, suffering from an aggravated form of the poisoning, the face being swollen to such an extent as to wholly obliterate the features, and the eyes being entirely closed. Dr. Morris made an application of zinc-oxide ointment, and ordered applications of a solution of 2 drachms of carbonate of sodium in 3 oz. of water, on absorbent cotton. The result was negative. On the third day after the onset he made an application of pure guaiacol, freely painting it over the inflamed area with a camel's-hair brush, and then covering the parts. On the next day there was marked amelioration of the trouble, and on the fourth day after beginning the guaiacol treatment the poisoning and its resulting inflammation had entirely disappeared.

The other patient was a boy of eleven years with the same trouble, one side of the face and neck being affected to about the same extent as in the previous case. Dr. Morris used guaiacol, and on the second day the boy was out and at school, the trouble having entirely abated.

Guaiacol cinnamate.—See STYRACOL.]

Guaiacol phosphate, $PO(C_6H_4OCH_3O)_3$, occurs in hard, colourless tablets, melting at 98° C. It is insoluble in water, in alcohol, and in ether, but is easily soluble in acetone and in chloroform. The dose has not been determined.

Guaiacol succinate is an ester of guaiacol. Its formula is $C_4H_4O_4(C_6H_4OCH_3)_2$. Its crystals are silky needles. It is insoluble in water, slightly soluble in ether and in alcohol, and freely so in chloroform.

SAMUEL M. BRICKNER.

GUAIECETIN. — According to Dr. J. Strauss (*Centralblatt für innere Medicin*, June 20, 1896; *New York Medical Journal*, July 11, 1896), who has experimented with this substance, which is a pyrocatechin-monacetic acid, $C_6H_4\begin{matrix}OCH_2COOH\\OH\end{matrix}$, obtained by introducing the carboxyl group into guaiacol, it is a tasteless powder. He gave it in doses of 7 grains, several times a day. On the whole, he thinks that it is not quite so apt to produce unpleasant effects as either creosote or guaiacol carbonate.

GYMNASTICS.—For the Schott method of treating chronic heart diseases, see under BATHS (Supplement).

GYMNEMA.—The leaves of *Gymnema silvestre*, an East Indian asclepiadaceous shrub, when chewed, have the effect of temporarily destroying the sense of taste for sweet and bitter substances. Their active principle, *gymnemic acid*, $C_{32}H_{55}O_{12}$, has the same property, and a 12-per-cent. solution of the acid in water containing enough alcohol to dissolve it has been employed as a mouth-wash to dissipate the taste of bitter medicines (Coblentz, *op. cit.*).

HEAT.—The local application of dry hot air in the treatment of *rheumatism* has lately been attended with most gratifying results. It is essential that the hot air should be as dry as possible; otherwise, it will cause pain. Special appliances have been devised for drying and heating the air, and for restricting its contact with the body. At a recent meeting of the Harveian Society of London (*British Medical Journal*, November 21, 1896; *New York Medical Journal*, December 12, 1896) Dr. Knowsley Sibley presented a woman, twenty-six years old, who had been a complete cripple from rheumatism for nearly three years. Her mother and her mother's grandfather had suffered from the same complaint. The patient had had very fair health up to three years before. She had never been laid up with fever and there was no cardiac lesion. She had been for many months under treatment at Bath, but without getting any better. She was sent up to London for treatment on September 30, 1896. On her admission, the following note was made: "The patient has used a pair of crutches for two years, and can just manage to get about on the level with the aid of these; she can not get up or down stairs, wash or dress herself, or do her hair. She feeds herself with great difficulty, and only with a large spoon and fork, as she can not get either hand within several inches of her mouth. She can not rotate the elbows, which are nearly fixed at right angles. There is considerable thickening of the middle fingers of both hands, and grating and limitation of movements at the shoulder joints. The right knee is ankylosed nearly at a right

angle; there is absolutely no movement of any kind to be elicited; the thigh and especially the calf muscles of this leg are much wasted; the patient can just touch the ground with the tip of the toes, but is unable to put any weight on the limb, and in fact can not raise it off the bed when lying on her back; there is constant pain of this joint; she wears a gutta-percha splint round it as a protection."

The localized hot-air treatment, continues Dr. Sibley, was begun on October 1st. After the second application it was possible to rotate the left elbow, and after the third the patient was able to see the palms of both hands, which she had not done for two years. After the sixth bath she was able to do her front hair, and after the tenth she was able to walk a few steps without her crutches, and there was distinctly some movement to be obtained in the knee joint. She had now had twenty-seven baths, and could get her left hand all over her face, head, and neck, and get up and down stairs with ease. There was also a fair amount of movement in the right knee joint; the patient could flex and extend it some few inches. All these results had been obtained without at any time putting her under an anæsthetic and breaking down the adhesions, as was originally suggested; and at no time had she any pain or effusion in any of the joints under treatment. Before and after each application of the dry air, which was heated to a temperature of 260° F., the limbs were gently manipulated and massaged. She had been taking some syrup of iodide of iron, and the bowels were regulated with Condal water.

Dr. Virgil P. Gibney (*Medical Record*, January 23, 1897) reports seven cases of *stiff and painful joints*, including the rheumatic, the tuberculous, and the traumatic, also a case of apparent deformity due to *chronic sciatica*, in which he has applied this treatment in the Hospital for the Ruptured and Crippled. In all these cases more or less relief from pain and stiffness was afforded, and in several of them it was very decided.

HELIOTROPIN.—See PIPERONAL.

HOMOGUAIACOL.—See CREOSOL.

HONEY.—Dr. E. Lerede Chalke, a civil surgeon of Negapatam (*Indian Medical Record*, May, 1896; *New York Medical Journal*, June 13, 1896), says that he has had hundreds of cases of *scorpion stings* to deal with and has tried various remedies to relieve the stinging pain and burning sensation which invariably are the chief symptoms for which relief is sought, and he finds that the application of honey to the affected part acts the best, producing almost instant relief. The stinging and burning sensations vary in degree according to the species of the scorpion which causes the sting. He has seen the small, pale, reddish-brown scorpions in the ceded districts evoke unbearable pain in the part stung, while the black, huge ones so common in the Kurnool district (about six inches in length, with hair on the back and claws like those of crabs) cause great agony to the victim, making him simply writhe under the pain.

He recalls the case of a delicate middle-aged woman, who was suffering from heart disease, and was stung by one of the black kind, a huge monster with formidable claws and a big sting. The woman was carried to his bungalow in great agony, cold and clammy, and begged of him to relieve her of the intense pain which, she said, she could bear no longer. There was a large gathering in his place at the time, including two physicians. He immediately brought the honey, which he applied gently but freely over the affected part. The relief was almost instantaneous, to the astonishment of the patient and the spectators, particularly the physicians. At the same time he gave her 10 minims of chlorodyne with brandy, which roused her spirits within a short time. He applied the honey again after an interval of five minutes, when the patient expressed herself nearly rid of the pain and comfortable.

This, he says, was one of several cases he has treated with honey, and he has always found it a very reliable and prompt medicament. If honey is not procurable at the time, a strong solution of sugar in water will be found a very effective substitute. He has also tried over-ripe plantains squeezed and applied as a poultice over the affected part, which acts speedily in subduing the pain and burning sensation.

HYDRIATICS.—For the Schott method of treating chronic heart diseases, see under BATHS (Supplement).

HYDROCHLORIC ACID.—At a meeting of the American Orthopædic Association held in May, 1896 (*New York Medical Journal*, August 8, 1896), Dr. Jerome Hilton Waterman reported eight cases of *necrosis of bone of tuberculous origin* which he had treated by the use of hydrochloric acid at the Hospital for the Ruptured and Crippled, New York, cases some of which had not done well under the usual methods of treatment. In some of these the most radical operative means had been employed, the bone being thoroughly curetted and all the necrosed tissue supposed to have been removed. Sinuses subsequently formed, and an examination under anæsthesia revealed the fact that necrotic bone was still present. In the other cases of the series, irrigation with solutions of bichloride of mercury, applications of hydrogen peroxide, packing with various kinds of gauze, and the injection of creosote and protonuclein into the sinuses had been employed for many months without favourable results, either in decreasing the amount of discharge or in allaying the progressive character of the pathological condition. Confronted with these unsatisfactory results, Dr. Waterman resolved to try the application of hydrochloric acid. The theory was that the action of the acid on healthy bone was limited to the decomposition of the mineral constituents, consisting principally of phosphates and carbonates of calcium, together with small quantities of the alkaline salts, not affecting the animal matter, and that in necrosed bone there were only these mineral salts remaining, to which the chemical action of

the acid was more particularly confined, dissolving it without exerting any destructive influence on the underlying tissue. In this fact, says Dr. Waterman, lies one of the real merits of the treatment, for, the diseased tissue being removed, the process of repair can go on unobstructed.

The acid was used in the concentrated form, whereas before for the most part dilute solutions and solutions in combination with various substances had been used by other surgeons. The number of minims injected in each individual case depended on the amount of bone which was diseased and on the general condition of the patient. It is preferable, says Dr. Waterman, not to use the acid more than twice a week, owing to the reaction and pain which might result. However, in his cases but little pain was experienced, and this he attributes in part to the fact that the patients were accustomed to more or less manipulation, having been dressed daily for several months, and also to the anæsthetic effect of the acid. In case it should produce undue discomfort, he says, it is advisable to spray the tissues with a 4-per-cent. solution of cocaine or cocaine and morphine a few minutes before injecting the acid, or else employ the chloride-of-ethyl spray. He washed out the sinus thoroughly with sterilized water in order to remove any pus or detritus, and thus permit the acid to penetrate all of the diseased bony tissue.

An ordinary sterilized glass pipette was found convenient for the application of the acid. The tube was introduced to the bottom of the sinus and the contents were deposited directly upon the necrosed structure. After this he usually allowed a minute to elapse, then irrigated the sinus with a saturated solution of bicarbonate of sodium, and then applied a wet myrrh dressing. His object in using the latter in preference to dry dressings, he says, was because of the marked fœtor noticed in many instances after the first two or three injections, which is accounted for by the destruction of soft tissues; consequently it is more pronounced when the patient moves during the application, so that it is not made directly to the bone, but partly on the surrounding tissues.

In certain cases of the series it was necessary to enlarge the opening during the course of treatment, particularly when the granulations were so exuberant as to protrude into the lumen of the sinus, but in the majority of instances they could be removed by the introduction of a probe.

Of Dr. Waterman's eight cases he reports four apparent cures. He suggests the possibility that in two of the others either the necrosed area was larger than the probe indicated, so that not sufficient acid had as yet been applied to effect the solution, or another area of necrosis existed at some distant point not indicated by the probe. Should these conditions be present, he says, operative methods are necessary.

For the use of dilute hydrochloric acid in conjunction with pyrozone in suppurative otitis media, see under PYROZONE (Supplement).

HYGIAMA.—This is the name of a proprietary food made of condensed milk with the addition of certain cereals specially prepared and of cocoa deprived of its fat. It contains 20·4 per cent. of albuminous matter, 10 per cent. of fat, and 63·4 per cent. of carbohydrates. According to von Noorden, it is particularly useful in *diseases of the stomach* and *intestines*, in *pulmonary consumption*, in the *debility of convalescence*, in *typhoid fever*, and in weakly children. (*Berliner klinische Wochenschrift*, 1896, No. 20; *Deutsche Medizinal-Zeitung*, May 21, 1896.)

HYOSCYAMINE.—Dr. Chalmer Prentice, of Chicago (*New York Medical Journal*, January 2, 1897), calls attention to the action of hyoscyamine in *paralysis agitans*, and reports three cases. The first was that of a clergyman, sixty-five years old, first seen by Dr. Prentice in January, 1891. Shaking of the head and right upper and lower extremities had continued for a period of four years, gradually increasing in severity. Dr. Prentice used a solution of hydrobromide of hyoscyamine, 2 grains to the ounce of water. This was dropped into each eye. In twenty minutes the shaking of the upper and lower extremities and head had entirely ceased. At the end of three quarters of an hour there was such a general relaxation that the patient was unable to rise from the chair. The intelligence did not seem to be disturbed, but the organs of speech were very much interfered with, so that it was difficult for the patient to talk. Dr. Prentice says that he anxiously watched the patient, sitting and talking with him for a period of two hours, at the end of which time he was able to get up from his chair and walk again. At the end of three hours there was no impediment to the speech and the shaking had not returned. At the end of about six hours the patient said the symptoms had gradually begun to present themselves again. On the following day the strength of the solution was reduced to 1 grain to the ounce. This did not interfere with the locomotion or the power of speech, but again put the shaking in abeyance. Dr. Prentice followed this case up for a month, during which time the paralysis agitans was kept under almost complete control by instilling a drop into each eye morning and evening, a solution of the strength of a grain to the ounce being used.

The second case, that of a farmer, sixty years old, was seen in 1892. He had suffered with paralysis agitans for twenty years. No lesions were present to which any reflex action could be attributed. In this case Dr. Prentice started with hyoscyamine, a grain to the ounce. In thirty minutes the shaking had almost entirely ceased, and the patient remained quiet during the day. A return of the symptoms came on the following morning, but they were not so severe as usual. Dr. Prentice reduced the strength of the solution to half a grain to the ounce, and advised its use three times daily. By following this treatment this case was kept entirely under control for a pe-

riod of about two months, at which time Dr. Prentice lost sight of the patient.

The third patient was an unmarried lady, aged forty-five years, first seen in May, 1893. In this case there were some strong evidences of tabes dorsalis with slight curvature in the dorsal region of the spine. The shaking was general and most torturing. A solution of hyoscyamine hydrobromide, a grain to the ounce, reduced the shaking to a minimum, and gave almost perfect relief. In this case, says Dr. Prentice, hyoscyamine seems to have been the only remedy that has ever affected the patient, and for a period of three years she has depended upon it. There has been no necessity to increase the dose, and during all this time there has been no period in which she could stop using the hyoscyamine without a return of the violent shaking.

Dr. Prentice says he hardly believes the effect can be due to the action of the drug after it has been absorbed into the circulation, for the amount so taken in from one small drop in each eye, accounting for the amount washed away by lacrymation, he remarks, would not be over $\frac{1}{1\,0}$ of a grain, whereas the administration of $\frac{1}{2\,0\,0}$ of a grain by the mouth will not produce any like effect. He suggests that perhaps the reason for the marked effect of such a small amount of hyoscyamine in the eye is the fact that the site of its application is in close proximity to the cause of some reflex disturbance through the visual and other allied centres.

ICHTHYOL.—Guintsburg (*Médecine moderne*, May 13, 1896; *Therapeutic Gazette*, September, 1896) strongly recommends the use of ichthyol in *intestinal disorders*, particularly those which accompany affections of the genito-urinary tract in women. The dose is 4 or 5 grains a day, preferably in keratin-coated pills, which are believed to pass through the stomach undissolved; thus a disagreeable taste and eructations are avoided. The medicine is best given some little time after meals. Good results were obtained in cases of *diarrhœa:* the appetite improved, the abdominal pains were much decreased, and the patient gained in weight; at the same time, if there was a tendency to menorrhagia, the menstrual function became more nearly normal. The best results were in cases of *rebellious constipation.* He failed to meet with any disagreeable symptoms such as are recorded by Bouchonieff, who found that in persons suffering from renal disease or from chlorosis ichthyol was apt to produce loss of appetite, nausea, and vomiting. He attributes these disagreeable results to too large doses.

Dr. Le Tanneur (*Journal de médecine de Paris*, August 9, 1896; *Journal of the American Medical Association*, September 12, 1896) has experimented with ichthyol to determine its *antiseptic* power and its effects in *pulmonary tuberculosis.* He states that absolute sterility is secured with a 5-per-cent. solution, although the shape of the Koch bacillus is altered and its development much retarded with a 2-per-cent. solution and even a weaker one. He administered it to his patients in capsules (Chiron's) which contained 4 grains each, giving from four to twenty-four a day. No effect followed the administration of six or eight capsules. M. Le Tanneur began with two capsules and increased the number to twenty a day, taken three times a day, during the meals. None of the fifty patients treated suffered any inconvenience from its use, and several patients with *diarrhœa* and *gastric disturbances* were cured of those complications by it. The cough was much improved owing to the liquefaction of the sputa produced by the ichthyol, which also cured the congestion of the bronchial tubes. The colour of the expectoration changed from green to yellow, then to gray, and finally to the ordinary colour of mucous secretions. The dyspnœa was relieved at once by the liquefaction of the sputa and the decreased congestion, which rested the heart and raised the general tone of the system. Pain in the intercostal regions was also much relieved, probably for the same reason. The general health did not show improvement so soon as with hypodermic injections of guaiacol, but it arrived and progressed none the less surely, and the patients gained flesh much more than with guaiacol. Several gained from seven to eight pounds in the first month, others gained four pounds, and two thirds of the patients showed a marked increase in weight. The sweats also diminished, but apparently only as the general health improved, as this effect was not noticed so promptly as with creosote or guaiacol. The appetite was not unfavourably affected as is frequently the case when guaiacol is used, but it was improved and restored to normal in many cases. Le Tanneur concludes that, while ichthyol is by no means the long-sought specific for consumption, yet great benefit is derived from its use as a substitute for creosote and guaiacol, when, as often happens, the system has become so habituated to them that they fail to affect it. It is especially indicated in *bronchial tuberculosis*, which it most promptly relieves. Its disagreeable odour renders the use of the capsule imperative.

Dr. William J. Robinson (*New York Medical Journal*, November 14, 1896) reports a remarkable case of *lymphangeio-phlebitis* in which ichthyol proved speedily efficacious. The patient was a thin, badly nourished man, fifty-three years old. The disease affected the left lower limb, which was swollen to about double its normal size, of an erysipelatous red, and exquisitely painful. The long saphenous vein was felt as a hard, rigid cord, exceedingly sensitive to the touch. There was an ulcer on the leg, described as small, superficial, and altogether insignificant. The man had two inguinal herniæ, which descended through the canals at the least strain. On the back, at the point of pressure of the truss, there was slight ulceration. He had intense headache, absolute loss of appetite, constipation, chills, and occasionally syncope. His temperature was 101·8°, and his pulse 120, small and compressible. Dr. Robinson prescribed phenacetine and salol, also

a mixture of cardiac stimulants, and ordered for the leg continuous hot fomentations of a 3-per-cent. solution of carbolic acid with lead-and-opium wash. The fomentations relieved the pain, but the inflammation did not abate. Dr. Robinson then used creolin, a 1-to-1,000 solution of corrosive sublimate, and carbolic and salicylic-acid ointments in succession, but without being able to check the continuous, uninterrupted upward progress of the disease. Not only the entire limb was intensely inflamed and œdematous, but the left side, to about the level of the umbilicus, was in the same condition. The scrotum and penis attained enormous proportions. The man was unable to move, and his sufferings were extreme. In about a month Dr. Robinson was hastily summoned early in the morning and found his condition such as to give rise to the gravest apprehension. The pulse was thread-like, 140 a minute; the temperature was 104°; the first heart sound was almost inaudible. He administered a hypodermic injection of digitalis, strychnine, and nitroglycerin, and ordered a 25-per-cent. solution of ichthyol in glycerin. He enveloped the inflamed parts in lint soaked in that solution, and covered it with cotton and oiled silk. At this time he entertained little hope of the patient's recovery, but in the afternoon of that day the picture had completely changed. The temperature was 100°, the pulse was 96, and the redness and œdema had diminished to a remarkable degree. The applications were repeated three times a day. On the next day the swelling had completely disappeared from the leg and genitals; on the back it persisted for two days longer. His convalescence from that day on was uninterrupted. In a week every trace of inflammation had disappeared, but he felt very weak. The man afterward had an attack of phlebitis in the right leg. The symptoms were practically the same as in the first attack, though not quite so severe. The treatment was repeated, but in addition Dr. Robinson ordered very large doses of ichthyol internally—a pill of 4½ grains every hour through the day and two or three times during the night. The result was highly satisfactory; in three days the man was quite well. Hard nodules were still to be felt in the course of the veins at the time of the report, but were disappearing rapidly under the internal and external use of ichthyol. For external use Dr. Robinson prescribed ammonium sulphichthyolate, and for internal use sodium sulphichthyolate.

Dr. W. Ottinger, of Exbrücke (*Münchener medicinische Wochenschrift*, December 8, 1896; *Wiener medizinische Blätter*, December 17, 1896), has found ichthyol an admirable remedy in numerous cases of the *stings of flies, gnats, bees*, and *wasps*, and has found that it quickly and surely causes the phenomena of inflammation to subside. He attributes its effect to its vaso-constrictor action. It is best to apply it pure in a pretty thick layer, but it may be used in the form of an ointment.

IODOFORM.—The iodoform treatment of *suppurating buboes* has of late come into extensive use. It is described by Dr. William K. Otis (*Journal of Cutaneous and Genito-urinary Diseases*, May, 1893) as follows:

The skin for some eight or ten inches about the affected area is rendered thoroughly aseptic by scrubbing with green soap and washed with sulphuric ether and then with bichloride-of-mercury solution (1 to 1,000). A narrow bistoury is then inserted into the abscess cavity, the contents are gently but thoroughly squeezed out, and the cavity is irrigated with bichloride-of-mercury solution (1 to 1,000) and immediately filled to moderate distention with warm iodoform ointment (10 per cent. iodoform and 90 per cent. vaseline), care being taken not to use a sufficient degree of heat to liberate iodine. The syringe used for introducing the ointment is the ordinary cone-pointed glass syringe. The plunger being removed, the barrel is warmed in the flame of an alcohol lamp and filled with ointment by means of a spatula. On finishing the injection, at the instant of withdrawing the syringe from the wound, a compress wet with cold bichloride-of-mercury solution is applied, which instantly solidifies the ointment at the orifice and prevents the escape of that in the abscess cavity. A large compress of sterilized gauze is then applied by means of a firm spica. The patient is told to return in four days, when, if all is well, the dressing is reapplied, but if any evidence of inflammatory action is found the wound is thoroughly irrigated and cleansed and the injection repeated. Out of sixteen cases, Dr. Otis reports nine cured in six days, three in twelve days, one in fourteen days, and one in twenty-three days. He alleges the following advantages for this method: 1. It is simple and safe. 2. In suitable cases the cure, as a rule, seems more rapid than by any other method. 3. The patient is not prevented from going about during treatment. 4. The first gland being rendered thoroughly aseptic makes it less likely that other glands in the chain will become infected. 5. It leaves no telltale scar. 6. It in no way interferes with any subsequent surgical procedure, should such be deemed advisable. Dr. Otis says that his experience has demonstrated that this method is available only in those cases of infection by the staphylococcus in which there is an appreciable pus cavity, and thus a storage place for ointment until absorption can take place. In diffuse phlegmons, in which no pus cavity exists, the method has not been found applicable. Dr. Otis gives the warning that there is a probability of failure unless two cardinal points are observed: 1st, absolute cleansing of the cavity of all traces of pus; and 2d, the injection of ointment into it in quantity barely sufficient to produce moderate distention.

ITROL.—See *Silver citrate* (vol. ii, page 198).

JERVINE.—See under VERATRUM VIRIDE.

KAOLIN.—See *Fuller's earth*, under EARTHS (vol. i, page 353).

KRUMMHOLZ OIL.—See under PINE PREPARATIONS (vol. ii, page 88).

LACTOSE.—See SUGAR OF MILK.

LARD.—Dr. George Boody, of the Iowa State Hospital (*American Journal of Insanity*, July, 1896), reports the results of experiments made by himself with leaf-lard inunctions in cases of *malnutrition with emaciation*. The time over which they extended, he says, was very short and the number of cases few, but they were carefully carried out and the improvement in each case was noted. Four cases were selected, of each of which a brief account is given, with the following conclusions: 1. The integument plays an important rôle as an organ through which food may be taken, carried to the circulation, and assimilated, nutrition improved, and wasted tissue repaired. 2. Inunction with lard is indicated in every case of extreme emaciation with malnutrition in which diet and tonic treatment with massage fail to produce the expected results. 3. It is the author's belief that if the conditions were such that food could not be taken through the stomach, nutrition could be improved and the patient made to gain in weight by inunctions of leaf lard, olive oil, or other fats, twice or three times a day.

LEVULOSE, or fruit sugar (see vol. ii, page 235), has been employed, under the name of *diabetin*, as a sweetening agent for persons affected with *diabetes*.

MAGNESIA.—Vergely (*Revue médicale*, February 16, 1896; *New York Medical Journal*, March 14, 1896) reports favourable results from the use of calcined magnesia in the treatment of *burns* of moderate severity. The affected parts are covered with a thick layer of a paste which is prepared by mixing the calcined magnesia with a certain quantity of water. This paste is allowed to dry on the skin, and when it becomes detached and falls off it is replaced by a fresh application. Very soon after the paste is applied the pain ceases, and under the protective covering formed by the magnesia the parts recover without the cutaneous pigmentation which is often observed to follow burns that have been allowed to remain exposed to the air.

MARROW.—Dr. William O. Mann, of the Fergus Falls State Hospital, in Minnesota (*American Journal of Insanity*, January, 1897), gives his experience in the use of bone marrow among the insane, extending over a period of four months. Two preparations of bone marrow were used: One which was made at the hospital by finely chopping ribs of sheep and adding glycerin in the proportion of a pound to twelve ribs. This was allowed to macerate four days. It was then strained through gauze and was ready for use. The other preparation was that manufactured by Armour & Co.

Twenty-two male patients were selected, eleven of whom took one form of the extract, and the other eleven the other form. Those patients were chosen whose general appearance was anæmic. Extract of bone marrow was given for a month, a drachm three times a day, at the end of which time the percentage of hæmoglobin and the number of corpuscles were again ascertained, the same time of day being taken as at first. During this time no medicine was administered and the regular diet was given. Fifteen of the twenty-two cases were regarded as chronic, and the seven remaining were acute cases in which improvement had been slow and had reached a standstill.

Dr. Mann gives tables showing that in some cases the number of red corpuscles was normal, while the leucocytes were increased and the percentage of hæmoglobin was diminished; also that the ratio of the percentage of hæmoglobin to the number of red blood-cells was irregular. The average increase in red corpuscles was 1,361,489, and those that took the extract made at the hospital gained more than the others. The proportion of hæmoglobin increased on an average of 12·5 per cent. The leucocytes, which in nearly all had been abnormal at first, decreased in number at the end of the month. The general appearance in the majority of the cases had improved. The appetite was better and the action of the bowels more regular.

In only one case was there a tendency to diarrhœa. In the twenty-two cases there was an aggregate gain of forty-seven pounds, and on discontinuing the use of the marrow those that had lost immediately began to gain, and three months later weighed more than they ever had during their residence in the hospital. One man especially, that had weighed for months from ninety-six to ninety-nine pounds, now weighed a hundred and twenty-eight.

Dr. Mann's experiments seem to have been chiefly directed toward ascertaining the action of marrow on *anæmia* rather than on *insanity*, but he says that, mentally, one patient began to improve at once and soon went home recovered. Three were regarded as much improved, and four others were brighter and had lost a great deal of the apathy they had formerly had. In the fourteen others the only improvement noticed was in their physical condition. Dr. Mann concludes that the use of bone marrow in anæmia results in an increase in the red corpuscles of the blood, and in cases of insanity associated with anæmia improvement in the mental condition may be expected in at least a third of the cases.

MEDULLADEN.—This is the fanciful name of an extract of bone marrow. See MARROW.

MEDULLARY GLYCERIDE.—See under MARROW (vol. ii, page 599).

MENTHOL.—Dr. Sidney A. Bontor (*West London Medical Journal*, July, 1896; *New York Medical Journal*, August 1, 1896) has used menthol spray in forty cases of *whooping-cough*, most

of them selected, he says, on account of their severity, and the result has been most satisfactory; in thirty-nine of them the benefit was decided, and in only one did the spray seem to have no effect; this was a case complicated by acute bronchitis. One patient died, a weakly infant of only seven weeks, the immediate cause of death being convulsions in the third week of illness; in two the spray was not persevered with, although the paroxysms were relieved by it, because, as the attacks were not very severe, the parents thought the little smarting of the eyes an unnecessary infliction.

About 20 grains of menthol were dissolved in an ounce of liquid vaseline in an ordinary nasal spray-producer; as soon as the paroxysm began, or preferably as soon as the patient felt that one was impending, a fine cloud of spray was diffused in front of the face, the spray-producer being held about two feet away; by this means the air in front of the nose and mouth was saturated with the oily particles, and at each inspiration they were drawn into the air passages; this was quite painless, but occasionally a slight spasm of the glottis occurred. The effect of this inhalation is quickly seen, says Dr. Bontor, for the mucus is rapidly expectorated and the paroxysm is soon over, so that convulsions are less frequent and vomiting is rare, with the result that the patient loses his dread of taking food and eats with a better appetite, his general condition being thus kept at a much higher level. Among the forty cases there were none of prolonged debility, none followed by gastro-intestinal catarrh, and none at the time of the report with tuberculosis. The author does not, however, maintain that this result is wholly attributable to the form of treatment, because, he says, he practises in a healthy country district where the tubercle bacillus does not flourish and where the death-rate is naturally low, but he adds that the results among patients in the same district treated by other methods have not been so satisfactory.

MERCURY. — Rabinschek's method of treating *whooping-cough* with mercury bichloride is described in the *Bulletin médical de Paris* for September 13, 1896 (*Lyon médical*, October 11, 1896), as consisting in the introduction into the back of the mouth of a small tampon of cotton saturated with a 1-to-1,000 solution of corrosive sublimate, and pressing it against the lower part of the tongue in such a way that the liquid will bathe the epiglottis and the neighbouring mucous membrane. The method has been applied in seventy-one cases by Dr. Rocco Gentile; thirty-five patients were cured after from three to twelve applications, thirteen were considerably improved, and the others interrupted the treatment or had complications which did not depend upon the whooping-cough. One of the greatest benefits to be derived from this treatment is said to be the rapid cessation of the vomiting which contributes so much to weaken the patients. Gentile has never employed more than one application a day. In a very small number of cases he has observed temporary disturbances, such as hæmorrhages of the conjunctiva and of the ear, buccal ulcerations, and slight fever; but he says these complications are not serious.

Surgeon-Major Harold Hendley, of the British Indian Medical Service (*British Medical Journal*, January 16, 1897), refers to Celli's successful treatment of *tetanus* with subcutaneous injections of corrosive sublimate (mentioned in the *Medical Annual* for 1896), and reports a case of his own. A Hindu boy, aged nine, son of a hillman in the Kangra District, Punjab, was first seen on August 10, 1896, when it was stated by the father that he had been suffering for two days from stiffness of the neck and difficulty in mastication, associated with a considerable amount of pain. On examination, marked rigidity of the muscles connected with the lower jaw, the neck, and the right arm and thigh was discovered, and any movement of these parts was attended with very considerable pain. The temperature was 101·2° F., the pulse was 96, the bowels were constipated. On the 11th his temperature was 99·8° F., the bowels had been moved once; his condition was about the same. On the 12th a very considerable amount of pain was complained of over the front of the chest, more especially over the cardiac area, and a slight systolic *bruit* was audible at the apex. A belladonna plaster applied over the area of greatest pain resulted in some relief. On the 13th slight spasms became evident over the whole body at intervals of from fifteen to twenty minutes. Two grains of chloral hydrate were given thrice daily. A fair amount of sleep was obtained. On the 16th risus sardonicus and opisthotonos were well marked; the paroxysms became very frequent, occurring at times every two or three minutes, and any movement of the patient increased their frequency. The bowels were again constipated, the temperature was 100·2°, F., and the pulse was 100, small and weak. Pain was very considerable; next to no sleep was obtained, and, in spite of the considerable amount of fluid nourishment taken in the shape of milk and soup, the patient had become considerably emaciated. Two grains of chloral hydrate were now given every hour, and the dose of calomel, 4 grains, which had been given on his admission, was repeated.

From the 17th to the 26th, by pushing the chloral hydrate and so producing sleep, some control over the paroxysms was obtained. On the latter date, however, the patient became much worse; the paroxysms increased in severity and frequency, and a fatal ending seemed not far off. As the chloral hydrate appeared to have no longer any effect upon the course of the disease, it was determined to have recourse to Celli's treatment. The use of chloral hydrate was continued, and subcutaneous injections into the buttocks of corrosive sublimate in doses of about 0·09 of a grain were given twice daily, beginning on August 27th. After the first two injections the spasms decreased decidedly in frequency and severity.

On September 2d—that is, after eleven injections—the paroxysms had entirely ceased, and from this date, when the injections were

stopped, recovery was sure, and, considering the previous state of the patient, fairly rapid. Small doses of chloral hydrate were continued up to September 8th.

It is noticeable, remarks Surgeon-Major Hendley, that, as in Celli's case, very marked amelioration in the patient's condition occurred after the second injection. After a very careful inquiry, no cause for the occurrence of the disease could be discovered. The early symptoms seemed to point to conditions which might admit of the case being classified as one of rheumatic tetanus.

METADIHYDROXYBENZENE.—See RESORCIN.

MILK.—Lachmann's so-called "vegetable milk," says a writer in *Médecine moderne* for September 9, 1896 (*Lyon médical*, October 4, 1896), when made with almonds and sugar, does not contain any starchy substances and has a sufficiently large quantity of emulsified fat. Its composition is as follows:

Fat	24·60	per cent.;
Vegetable casein	7·50	"
Cane sugar	41·80	"
Vegetable dextrin	1·30	"
Lime, potassium, etc.	0·68	"
Water	24·12	"

This vegetable milk may be used to dilute cow's milk which is too rich in albuminoids. For this purpose it is superior to water, as it does not precipitate the casein in large flakes, but in small and soft ones. Furthermore, the addition of vegetable milk to cow's milk increases the fatty substance of the latter and accelerates its digestion.

MORINGA.—The *Moringa Pterygosperma*, the Oriental horse-radish tree, or drumstick tree, has been used in medicine. Mr. L. B. Dhargalkar, of Bombay (*Indian Lancet*, September 1, 1896; *New York Medical Journal*, October 19, 1896), has used the root-bark in the treatment of *jaundice*. He says the root, the gum, the leaves, the flowers, and the fruit are all useful in medicine. The root has a strong, pungent odour and is said to have the flavour of horse-radish. When distilled with water, it yields an essential oil which is very pungent to the taste. The bark is rubefacient and is used externally by the poorer classes as a *counter-irritant* in *chronic rheumatism*. Some authors state, says Mr. Dhargalkar, that it is supposed to act as an *emmenagogue* and is used to produce abortion. The stimulant and pungent properties of the root-bark have been described by other observers, but Mr. Dhargalkar thinks that no one has as yet mentioned its usefulness in the treatment of jaundice. He himself accidentally found that, if administered in proper doses, it was useful in that disease, and he has made several experiments with it. He relates the histories of eight cases in which he obtained satisfactory results with the tincture of moringa, the action of which was very rapid.

In regard to the toxic effects of the drug, he states that he has had no opportunity to observe them, as it did not produce any unfavourable symptoms in any of the patients treated by him. In order to try its effects on the healthy system, he took on an empty stomach a drachm of the tincture in an ounce of water. It tasted, he says, something like an infusion of bitter almonds and produced a sensation of warmth at the pit of the stomach for two or three minutes, but it had no other effect. The physiological action of the drug is, he says, still unknown to him.

MONOCHLORMETHANE.—See *Methyl chloride*, under METHYL.

MONOPHENETHYDRIN.—See APOLYSINE.

MYDROL.—This name has been given to a new *mydriatic* said to be an iodomethylate of phenylpyrazol, which is a white, odourless, bitter powder readily soluble in water. It seems from experiments made under the direction of Professor Albertoni, of Bologna (*Therapeutische Wochenschrift*, December 6, 1896; *New York Medical Journal*, December 26, 1896), that mydrol dilates the pupil in animals that have a round pupil, but has no such effect on those in which the pupil is oblong. Dr. Cattaneo, of Professor Tartuferi's clinic, is cited as having found that, by reason of the short duration of its mydriatic action, when employed in a solution of from 5 to 10 per cent., and its transitory effect on the accommodation and especially on the tonicity of the eye, its diagnostic use is of advantage in cases in which there is reason to apprehend harm from the increase of intra-ocular pressure caused by other mydriatics. Albertoni adds that it is absolutely unirritating and non-poisonous, and that it excels cocaine in diminishing the amount of blood not only in the vessels of the conjunctiva, but also in those of the iris and most probably in those of the deeper structures. By virtue of these properties, while it has no actual anæsthetic action, it is serviceable in *ciliary* and *supraciliary pain*, *blepharospasm*, *lacrymation*, and many diseases of the iris, the cornea, the sclera, and the conjunctiva, especially that of the globe. Mydrol is said to be absorbed rapidly and to be eliminated unchanged in the urine.

MYELOTHERAPY.—See under SERUM TREATMENT (vol. ii, page 187).

MYRTILLIN.—A thick extract of the berries of *Vaccinium Myrtillus*. See under VACCINIUM (Supplement).

NAPHTHALAN.—This is described by Dr. Rudolf Isaac, of Berlin (*Deutsche medicinische Wochenschrift*, December 24, 1896), as an ointment-like mass obtained by the fractional distillation of crude naphtha from the highlands of Armenia. It melts at about 158° F. It is insoluble in water and in glycerin, but dissolves readily in ether and in chloroform, and mixes easily with fats. Naphthalan seems to have been first employed, early in 1896, in the Michael Hospital in Tiflis, in various skin diseases. Dr. Isaac reports upon its

use in about fifty cases in Dr. Max Joseph's Poliklinik for skin diseases in Berlin. Most of the cases were *chronic eczema*, especially the so-called "*occupation-eczema*," a few were *acute eczema*, and the remaining ones were single cases of *prurigo, pruritus, psoriasis vulgaris, ichthyosis, eczema impetiginosum, eczema occurring as a sequel of scabies, diabetes, ulcer of the leg*, etc. The results were various. In several cases of eczema rapid improvement leading to a cure was observed, in others the good effect was only temporary, and in a few so much irritation was produced that the use of the remedy had to be abandoned. There was no noteworthy effect in the cases of psoriasis.

Naphthalan is absorbed by the skin very rapidly, but Dr. Isaac thinks it doubtful on that very account if its employment as a constituent of a mercurial ointment for the inunction treatment of *syphilis* would be of advantage, since by the ordinary method time is given for the vaporization of the mercury and its absorption by the respiratory mucous membrane. Another disadvantage of naphthalan is that it soils the linen, but the stains are readily removed.

NITROUS OXIDE.—Dr. Hobart A. Hare (*Therapeutic Gazette*, December, 1896; *New York Medical Journal*, January 2, 1897) reports a case of death after the inhalation of this gas—not, he says, as one of death due to the direct influence of nitrous-oxide gas, but as an instance of the fact that the decided rise of arterial pressure which is produced by the administration of this drug during the period of anæsthesia may cause the rupture of a blood-vessel in persons who have a tendency to apoplexy.

A man between fifty and sixty years of age, with atheromatous arteries, visited the office of a well-known dentist who makes a specialty of extracting teeth under the influence of nitrous-oxide gas, in order that he might have removed one or two molar teeth which were giving him trouble. He had often taken nitrous-oxide gas in the same dentist's office on previous occasions, and always without any ill effects whatever. On this occasion he took the ordinary quantity, his teeth were extracted, and he returned to consciousness with the usual rapidity. He left the dentist's chair, walked to a washstand, and began to rinse out his mouth with water. While doing this he stated that his right hand felt numb, then complained of the extension of this numbness up his arm, and rapidly to his leg and side. He was helped to a sofa, where in the course of a very few minutes he became partially unconscious. When Dr. Hare saw him the attack had already lasted about twenty minutes. The patient was breathing stertorously. He seemed to understand questions put to him, but was unable to answer them clearly, and in the course of a very few minutes passed into absolute insensibility, which, notwithstanding the use of venesection and other measures, deepened into coma, in which he died about twelve hours after taking the anæsthetic.

NUCLEINS.—Dr. John Ferguson, of Toronto (*Canadian Medical Review*, March, 1896; *New York Medical Journal*, June 6, 1896), records a case of *progressive anæmia* in which protonuclein proved curative after a failure of other drugs. Preparations of iron and arsenic had been tried fairly, but could not be tolerated. The patient was a gentleman, aged fifty-four years, who had resided in India for several years. His health had not been good for about two years. During this period he had suffered loss of flesh, strength, and appetite. In April, 1895, the symptoms became more distressing, and it was necessary for him to give up his work as a tutor and rest. He became a patient of Dr. Ferguson's about the end of September, 1895. At this date he was a pronounced victim to insomnia. His digestion was extremely bad; he had much pain and frequent nausea after taking nourishment, either liquid or solid. There was an excessive amount of flatulence. The bowels were very torpid. The pulse was weak, and usually as frequent as 100 a minute. There was always some elevation of temperature, sometimes as high as 102° F. Continuous headache was another feature of the case.

The lips and conjunctivæ were almost colourless, and the tongue was exceedingly pale. The skin had a pale lemon tint. The red blood-corpuscles were only 1,200,000 to the cubic millimetre. The urine was normal. No organic disease could be discovered. In spite of all efforts of treatment and feeding, he gradually grew worse.

Dr. J. E. Graham saw the patient in consultation. No other disease could be discovered than progressive anæmia. It was agreed to place him in some hospital for a time. He was admitted into the Toronto Western Hospital on January 7, 1896. Dr. Ferguson went with him in the coupé, and says he really feared he would collapse on the way. When he arrived at the hospital he was in such a state of exhaustion as to be unable to walk upstairs. On being taken into his room he became unconscious, and in this condition he was hurriedly undressed and put to bed with hot bags around him. In the course of an hour or so he gradually regained consciousness.

At this stage of his disease there were varying elevation and a subnormal condition of the temperature. He had intense headache and almost continuous insomnia. The bowels were constipated, and nearly everything in the way of nourishment was vomited. The patient was in a state of extreme emaciation and asthenia. There were frequently low delirium and confusion of thought. He often regarded himself as a duality.

On his admission the bowels were washed out daily with a large enema containing some boric acid. Daily he was given a sponge bath. The stomach was washed out every day except occasionally when he felt too weak. He was fed on peptonized milk, egg albumen, and beef juice. The headache continued, however, in a most intense degree, and there was no improvement in the insomnia. For the headache, acetanilide, phenacetine, salol, and other agents

were employed, but with only the most temporary relief. Opium, chloral, paraldehyde, and sulphonal were administered from time to time for the insomnia. On one occasion 30 grains of sulphonal were given, with the result of causing only a few hours' imperfect sleep, followed the day after by much vomiting, great restlessness, extreme headache, and a feeble pulse.

He had been in the hospital a little over two weeks, and all the appearances pointed to an unfavourable termination of the case, when he was now placed on the use of protonuclein (tablets), as prepared by Reed & Carnrick. The enemata, lavage of the stomach, and the same nourishment were continued. Tablets were given every three hours. By the third day it became apparent that the patient was improving. The headache was the first symptom to become modified. In a week it had almost wholly disappeared, and at the date of the report was entirely gone.

The sleep soon became better. By the end of the first week of the use of protonuclein he would sleep three and four hours at a time. At the time of the report he could sleep from six to eight hours, and woke with a rested and refreshed feeling. The appetite was good; he could take eggs, meat, toast, porridge, oysters, beef juice, bread and butter, milk, and light puddings without the slightest discomfort. There was no nausea or vomiting; the bowels were quite regular, and no enemata or aperients had been administered for at least ten days. The temperature was constantly normal. The patient was gaining in flesh and could walk about the ward and in the hall for an hour and experience no ill effects. The lips and nails had a good colour, and the tongue had lost its pallor. The abdominal walls, which had been extremely retracted, were now filling with adipose tissue. The most marked change, however, was to be found in the red blood-globules. When the protonuclein was first ordered there had been not quite 1,000,000 to the cubic millimetre. Now there were 3,500,000. The progress of the patient had been one of daily improvement. He was to leave the hospital in two or three days, when the same line of treatment would be maintained, with the addition of a mild course of massage to assist in the development of the muscles.

NUTROSE.—According to Dr. R. Stüve, of Frankfort-on-the-Main (*Berliner klinische Wochenschrift*, 1896, No. 20; *Deutsche Medizinal-Zeitung*, May 21, 1896), nutrose is another name for a certain compound of casein and sodium. He has found it of particular value in the case of children in *convalescence from scarlet fever, measles, diphtheria*, or *pneumonia*. Added to a milk or soup diet, it enriches the food in albumin, and thus hastens recovery. Its taste is agreeable, and it is utterly unirritating to the intestines, from which it is readily absorbed.

NUX VOMICA.—Dr. Thomas J. Mays, of Philadelphia, who regards the state of the nervous system as playing an important part in giving rise to *pulmonary tuberculosis*, says (*Journal of the American Medical Association*, October 10, 1896; *New York Medical Journal*, October 27, 1896) that, of all the drugs in the materia medica, there is none that compares favourably with strychnine in the treatment of this disease. 'Aside from its elective affinity for the whole nervous system, it possesses a special influence on the nerves which preside over the function of respiration. There is reason for believing that it also affects the peripheral sensory nerves. In small doses it stimulates, in medium doses it tetanizes, and in large doses it paralyzes the nervous system. The dose is a relative or a movable quantity, however, he says, for that which produces tetanus or paralysis at one time may act as a stimulus at another.

In regard to the action of strychnine in pulmonary consumption, continues Dr. Mays, if it is taken for granted that the lung disease is merely a superficial manifestation of disorder of the pulmonary nerve supply, the strychnine primarily raises the tone of the nervous system as a whole and that of the respiratory nerves in particular. In this way it not only increases the resistance of the lung to disease, but aids digestion, assimilation, and blood-building. In employing strychnine great care must be taken to avoid the danger point, yet at the same time this point must be approached as closely as is consistent with safety. The best way to bring about this object, says the author, is to begin with a moderately small dose of the drug, $\frac{1}{30}$ of a grain four times a day; give this for a week, then increase it to $\frac{1}{24}$ of a grain for another week: during the next give $\frac{1}{20}$ of a grain, the following week raise the dose to about $\frac{1}{16}$ of a grain, and so on, making a slight increase every week until nervousness, restlessness, or twitching of the muscles is observed, the signs of the beginning of strychnine intoxication. In most cases these symptoms do not develop until $\frac{1}{12}$ or $\frac{1}{8}$ of a grain or even a larger dose is reached. It must be understood that the drug is to be given in these doses four or even five times a day. The object is to impress the nervous system with the full stimulant effect of this drug. The sooner this end is attained the better will it be for the patient. For this reason, begin with small doses and work upward as rapidly as can be done with safety. After the desired point has been reached the question arises whether it is better to continue the largest dose or to resume the original. Dr. Mays thinks it best not to vary from this line during the remainder of the treatment, in order not to lose what has been accomplished. Keep the strychnine treatment up to the highest level of safety, he says, but shun the point where its stimulus extends into the region of tetanus and of paralysis. It is best, however, to reduce the dose somewhat at this point. If, for example, it is found that $\frac{1}{8}$ of a grain is a maximum dose, reduce it to $\frac{1}{16}$ of a grain, then gradually increase the dose again until $\frac{1}{8}$ of a grain is reached, and then return to $\frac{1}{16}$ or to $\frac{1}{32}$ of a grain. After the dose has been increased and decreased several times it will

probably be found that ½ of a grain no longer produces any dangerous symptoms, and that as much as ½ of a grain can be given. When administered in this way the drug may be given for an indefinite period to the majority of phthisical patients.

The remedial effects of the drug show themselves in various ways. The nervousness, sleeplessness, and pain in the chest will be ameliorated, and perhaps entirely disappear; the cough, expectoration, and dyspnœa will diminish; vomiting will abate; the appetite improves; the patient gains in flesh and colour; the weak and rapid acting of the heart will become slower and stronger; the red corpuscles increase in number, and the patient becomes more hopeful and brighter.

Evenhoff (*Vratch; Union médicale*, July 11, 1896) has experimented with strychnine as a remedy for *cardiac failure during chloroform anæsthesia*. Tracheotomy was practised on dogs, and a tube was introduced into the larynx and put in communication with a small bottle which contained chloroform. Artificial respiration was made in such a way that the air passed through the bottle, and it could be charged or not with chloroform. Before chloroformization the pressure was noted, then the air, charged with chloroform, was injected and, when the pressure fell to 0, pure air was thrown in and an intravenous injection of from 2 to 3 milligrammes of strychnine was administered. When the pressure finally became normal the animal again received inhalations of chloroform. In this way the action of the chloroform before and after the injection of strychnine was ascertained. The results of these experiments showed that, owing to these injections, dogs, which usually tolerate chloroform badly, could support the drug without inconvenience for a greater length of time. The favourable action of strychnine on chloroformization was thus demonstrated. Strychnine, however, has two inconveniences: it may possibly provoke a tetanoid attack, and, given in the dose employed by Evenhoff, it increases parenchymatous hæmorrhage.

Strychnine is often particularly valuable in the treatment of *pneumonia*. Dr. Hobart A. Hare, of Philadelphia (*Therapeutic Gazette*, April, 1895), says that the three sheet-anchors of treatment for pneumonia after the exudation has taken place are digitalis, strychnine, and belladonna. Of these, strychnine is the only one which we can use alone with advantage. The digitalis nearly always fails to stimulate the vaso-motor system sufficiently, and the belladonna has to be added to regulate the blood-flow by its vascular action. Often, when digitalis is used in pneumonia, the pulse is full, but soft and boggy, if such a term may be used; and, while the regularity and slowness, as well as the volume, may indicate the full action of digitalis, the patient fails to receive benefit and may have a leaky skin. Under these circumstances, belladonna, given in the dose of about 5 drops of the tincture every three or four hours, while the digitalis is given in 10-drop doses every six or eight hours, will produce marked improvement. The strychnine finds its great value as a whip to the entire system—as a whip which will pull the patient out of collapse or syncope, or overcome the peculiar torpor which is so dangerous a symptom in this disease, indicating, as it does, that carbon dioxide is accumulating in the blood, or that the poison of the disease is obtunding the nerve-centres. Particularly are strychnine and belladonna useful about the time of crisis, when the rapid fall of temperature takes away the stimulating effect of the heat and produces collapse.

Dr. Hare then alludes to a case exemplifying most strikingly the value of the drugs he is speaking of. A child of five years, having passed through the earlier stages of pneumonia rather uneventfully, arrived at the period for crisis. On the day that crisis occurred it sat up in bed for an instant, although the pulse was already weak from the fall in fever, and at once called out, "Light the gas, it's getting dark," and then passed into profound collapse. The case was a desperate one, and, in addition to external heat, Dr. Hare gave hypodermically $\frac{1}{60}$ of a grain of strychnine and $\frac{1}{120}$ of a grain of atropine every fifteen minutes till three doses were used, when the child showed signs of renewed vitality, became flushed from the atropine, and eventually recovered without any further symptoms of note.

Dr. Percy Kidd, of London (*Practitioner*, September, 1894), says he has used strychnine in the treatment of croupous pneumonia ever since he read an article published in *St. Bartholomew's Hospital Reports*, in the volume for 1886, by Dr. Herbert Habershon, who reported a series of cases of cardiac failure and two cases of double pneumonia treated with the drug. The indications for the use of strychnine, says Dr. Kidd, are mainly derived from the pulse. If the tension begins to sink, or if the frequency of the beats is much increased, strychnine should be used at once, and by subcutaneous injection, as Dr. Habershon rightly insisted, for in cases of grave disease absorption from the stomach is slow and imperfect.

OPIUM.—The occasional value of opium in stopping *hæmorrhage* is strikingly shown by a case reported by Dr. William Huntly, of Kotah (*Indian Medical Record*, May 1, 1894).

A man came to him on the morning following the extraction of a lower molar tooth. The bleeding had been very severe, and blood still flowed from the gum. Dr. Huntly stuffed the cavity with lint soaked in liquor ferri perchloridi, but this did not stop the bleeding. The man was very weak. Remembering the effect of opium, he gave him a full dose of the tincture, and in less than a minute the pupil contracted and the bleeding stopped. The patient was then ordered to take 20 grains of calcium chloride in an ounce of rain-water every two hours until he had taken 2 drachms. The bleeding never recurred. Dr. Huntly's views of the value of calcium chloride as a hæmostatic will be found in the supplementary article on that drug (vol. ii, page 428).

OPOTHERAPY.—This term is occasionally applied to treatment with animal juices and extracts.

OREXINE HYDROCHLORIDE.—Dr. Hohn, of Wiesbaden (*Therapeutische Monatshefte*, January, 1896; *Wiener klinische Wochenschrift*, April 30, 1896), remarks that orexine chloride should always be given in wafers, but that the uncombined alkaloid may subsequently be administered without the use of wafers, when one has made sure that it does not give rise to a sense of burning in the mouth or the œsophagus. Not more than 4 grains should be given at one dose, and the entire amount given in the course of twenty-four hours should not exceed 8 grains. A dose should be taken half an hour before the midday meal, and perhaps another shortly before the evening meal. Hohn has used orexine in thirty-three cases, and gives the histories of ten, including three of *anæmia*, one of *gastric catarrh*, one of *sequelæ (loss of appetite, pallor, debility, etc.) of catarrh of the large intestine* of several weeks' duration, two of supposed *incipient tuberculous pulmonary disease*, one of such disease positively recognised, and two of *vomiting of pregnancy*. In twenty-three other cases there was loss of appetite caused by anæmia in eight, gastric catarrh in six, and vomiting of pregnancy in one, and attendant upon convalescence in three. As regards the results, in five of the thirty-three cases they are not stated; in nine success was attained, according to the patients' accounts; in twelve, increase of the appetite was noted; in four, the result was doubtful; and in two, failure occurred (one was that of a phthisical patient in the last stages of the disease, and the other was that of an hysterical woman).

OROTHERAPY, ORRHOTHERAPY.—See SERUM TREATMENT and *The whey cure*, under DIETETIC TREATMENT.

OVARIAN JUICE, OVARIAN SUBSTANCE, OVARINE.—The expressed juice of the fresh ovaries of healthy young animals, filtered and treated by the method described under ANIMAL EXTRACTS AND JUICES, an extract, *ovarine*, made as described in that article, and the dried substance of the ovary, have all been used as remedies. The *Presse médicale* for August 15, 1896 (*New York Medical Journal*, September 12, 1896), publishes a report of a meeting of the Congrès français de médecine interne at which M. Spillmann and M. Etienne presented a paper on the treatment of *chlorosis* with these preparations. They thought that the morbid symptoms which often preceded menstruation might be considered as the result of an intoxication which disappeared after this function was established. If chlorosis, they said, was a disease of the ovaries, their functions were changed or abolished, and with the suppression of menstruation chlorosis appeared. And, on the other hand, a defective general condition interfered with and impeded recovery of the ovarian gland. If, however, the ovarian internal secretion was restored to the organism in any way, it was possible, perhaps, to stop the intoxication, to influence the organism in general, and to afford a means of recovery of the local ovarian affection.

The authors had made use of three products: The fresh ovaries of the sheep, dried ovarian substance, and ovarian juice prepared by the Brown-Séquard-d'Arsonval method. These remedies had been given to six chlorotic subjects, with the results that after the first dose very sharp pains, especially in the abdominal region, had been felt; there had also been headache and vague muscular pains. In two of the patients the temperature had risen to 99·1° and 100·2° F., and the pulse increased from 76 to 100. In three of the patients the remote results had been distinctly favourable; the general condition had been rapidly improved, the pallor diminished, the number of white globules increased, and the strength restored. In *amenorrhœa*, menstruation, which had been suppressed for over three months, had returned in one case in fifteen days after the beginning of the treatment; in another case it had returned at the end of three months. The authors concluded that, in the treatment of chlorosis, ovarine favoured the elimination of the toxines and introduced into the organism an antitoxic principle, and in this way exerted a favourable action on the general condition, on the formation of red globules, and on menstruation.

Dr. Mond (*Münchener medicinische Wochenschrift*, 1896, No. 36; *Gazette hebdomadaire de médecine et de chirurgie*, December 13, 1896) reports twelve cases of the use of ovarine in the treatment of *disturbances following oophorectomy* and the *menopause*, and says that in every case the effect of the treatment was remarkable. There was progressive attenuation of the disturbances from the beginning of the third or fourth day, followed by their complete disappearance at the end of ten or twelve days. The quantity employed was ten tablets a day, each containing 8 grains of fresh ovarian substance. He advises the employment of large doses in the beginning, which may be progressively diminished and increased again if the dose seems to be insufficient. He states that he has never seen the least symptom of poisoning in any case. In several cases he substituted for the ovarine tablets others which had the same taste, the same colour, and the same appearance, but contained only meat extract and salt. The administration of these tablets was regularly followed by the return of all the troubles, so that the administration of the real ovarine tablets evidently did not act by suggestion.

OXYGEN.—At the eighteenth annual meeting of the American Laryngological Association, that of the year 1896 (*New York Medical Journal*, August 29, 1896), Dr. George Stoker, M. R. C. P. I., of London, presented a paper in which he described his method of using oxygen in the treatment of *syphilitic* and *chlorotic ozæna* and *chronic suppurative otitis media*.

The oxygen is contained in a wedge-shaped bag made of mackintosh. This bag is placed between two boards, such as are used with the oxyhydrogen light. From the bag leads a tube, which terminates in a nose or ear piece. There are two taps—a large one on the bag, for the

purpose of filling it, and a small one to regulate the stream of oxygen during treatment. This bag contains a cubic foot of gas, or of gas and purified air mixed in equal quantities, and this amount should suffice for six hours' treatment. In the great majority of cases he uses equal parts of oxygen and purified air. This latter is prepared by being pumped by means of a bellows or hand ball through two wash bottles, the first containing some water and the second Condy's fluid. The bottles are attached to the bag for this purpose, and when the bag is half full it is detached from the bottles and filled up with oxygen. The bag being filled, the nose piece is passed into one nostril, the other nostril being plugged with cotton wool; the patient is directed to breathe through the mouth, the taps are turned on, and the treatment is begun. In ear cases the only difference is that the terminal piece is placed in the external auditory meatus, and in case of either ears or noses it is desirable to have several different-sized terminals to fit different-sized orifices. The oxygen should be allowed to pass into either the nose or ear from three to six hours daily. In nose cases it is best to use it about half an hour to an hour at a time, giving intervals of rest between the times. If used for more than an hour in nose cases it is apt to cause headache. The only additional treatment is using warm water to cleanse the parts during the day, never less than twice a day.

Dr. Stoker stated that of late he had been using the same treatment in cases of *purulent discharge from the antrum of Highmore, the frontal sinus*, or *the ethmoidal cells*, and up to that time the results had been satisfactory.

Injections of oxygen into the peritonæum have been recommended by M. Potain in the treatment of *ascites*. M. Teissier (*Province médicale*, July 4, 1896; *New York Medical Journal*, August 1, 1896) relates the case of a woman with ascites and general œdema. He punctured the abdomen and withdrew about fourteen pints of liquid, but the liquid collected again in six days. A second puncture was then made and followed by the injection of 1,300 cubic centimetres of oxygen. The operation was very well borne, and it did not provoke any pain or local reaction; there was also complete absence of fever during the following days. The circumference of the abdomen diminished from 128 to 102 centimetres, and the œdema of the lower limbs disappeared very rapidly. The oxygen was easily absorbed by the peritonæum. For a few days there was some gurgling, but this disappeared at the end of eight or ten days. At the time of the report the abdomen still measured 102 centimetres and sonorousness existed everywhere, even in the iliac fossa when the patient lay on her side. She was able to get up every day and walk in the open air. These results had been obtained in three weeks.

PELLOTINE.—This is an alkaloid obtained from *Anhalonium Williamsii*. Dr. Jolly (*Deutsche medicinische Wochenschrift*, 1896, No. 24; *British Medical Journal*, October 24, 1896) records some observations on the use of it as a *hypnotic*. It may be administered by the mouth or subcutaneously. The dose is from $\frac{1}{4}$ to $\frac{3}{4}$ of a grain, which may be repeated if necessary. In one case as much as $1\frac{1}{4}$ grain was given in two hours. Dr. Jolly has used pellotine in forty cases, and the results have been satisfactory, though in varying degree. In no case were any unpleasant after-effects noticed. He considers that this drug should receive further trial.

PHENETIDINE.—See PHENACETINE.

PHENOL.—Dr. Sbrana (*Riforma medica*, March 16, 1896; *British Medical Journal*, May 2, 1896) reports the case of an Arab, aged twenty-five, who, on November 10th, wounded his left big toe near the nail by striking it against a stone. The wound was immediately dressed with cobwebs full of earth. Two or three days later, as the part became painful, the wound was washed with urine, then covered with chalk, and over this a sheep's bladder was laid. On the 22d there was some difficulty in masticating. When the man was seen, on the 25th, there was well-marked *tetanus*, the temperature was 101·3° F., and there were risus sardonicus, complete trismus, opisthotonos, and general clonic convulsions. A hypodermic injection of a 2-per-cent. solution of phenol was given in the foot on the evening of the 25th, and three times a day afterward. On the 26th the necrosed last phalanx and part of the first were removed. On the 30th, the inguinal glands were enlarged and painful. On December 4th there was smart intestinal hæmorrhage, also a copious eruption of sudamina on various parts of the body. On December 11th the patient left his room quite cured. Cf. CARBOLIC ACID.

PICRIC ACID.—Mr. William Maclennan (*British Medical Journal*, December 26, 1896; *New York Medical Journal*, January 16, 1897) says that the admirable results which he has seen follow the free application of picric acid in solution to painful and extensive burns led him to try its effects in the treatment of certain skin diseases. He has employed it locally in a large number of cases, and has found it more efficacious than any other of the remedial agents commonly in use, and he thinks it worthy of a more extensive trial.

Acute eczema, he says, is rapidly relieved under the influence of picric acid, and, owing to the powerful *astringent* properties which this chemical possesses, it forms, when applied over a discharging or denuded surface, a protective layer of coagulated albumin and epithelial *débris* under which healing rapidly proceeds; and as a potent *antiseptic*, by inhibiting the action of the microbes on which the formation of pus depends, or destroying them, it completely prevents suppuration.

Applied as a pigment with a brush or piece of absorbent wool, even to an extensive surface, it is quite free from danger, and causes not the slightest pain, however vascular the surface may be. Almost immediately itching and smarting abate, and in a few days, when

the protective crust is removed or separates, the underlying skin is found to be comparatively dry, free from redness, and covered with a young epidermis.

Mr. Maclennan states that in that very troublesome form of acute eczema occurring in children (*eczema capitis et faciale*) which is usually so intractable to the ordinary methods of treatment, he has had most encouraging results from the use of picric acid. If the hair on the child's head happens to be long it should be cropped short, and all adherent crusts removed by means of poulticing. The raw surface should then be freely painted over, morning and evening, for three or four days in succession with a saturated watery solution. During this treatment the scalp and the face, when it is involved, should be protected by means of a calico mask. After the lapse of a few days the pellicle which has been formed by the action of the picric acid can be removed with some emollient if it has not previously separated, and, if any undue redness or moisture remains, a fresh application may be made. The cessation of irritation permits the child to sleep, and its general health soon improves. When the disease becomes quiescent, the local treatment can be combined with, or followed by, the internal administration of alteratives like arsenic or gray powder.

Although picric acid is so specially valuable in acute discharging eczemas, says the author, it will be found an efficient remedy in almost any superficial inflammatory affection. Thus, in three cases of *erysipelas* he has found a saturated solution of picric acid superior to any local remedy he has hitherto tried. It arrested the inflammation and prevented the disease from spreading, and much more rapidly diminished local discomfort than carbolic-acid dusting powder or ichthyol.

Aspland, he says, narrates the case of a soldier suffering from *diabetes mellitus*, who contracted ague. He was treated with picric acid. Under its influence the polyuria rapidly disappeared and the specific gravity fell from 1·032 to 1·018, and in a few weeks sugar was entirely absent from the urine.

In those very troublesome cases of *chronic simple diarrhœa*, and so-called *putrid diarrhœa*, with very offensive stools, Mr. Maclennan has employed picric acid largely. Often, when opiates and other astringents have failed, picric acid in grain doses has given rapid relief. The powerful astringent and antiseptic properties of picric acid diminish secretion and disinfect the intestinal canal. In this respect the action of carbazotic acid resembles that of carbolic acid, to which it is constitutionally related.

M. P. Brocq (*Revue internationale de médecine et de chirurgie*, July 10, 1896) employs the following formulæ in the treatment of *itching of the scrotum:*

(1) ℞ Picric acid..... 4½ grains;
Vaseline, } each..... 225 "
Lanolin, }
M. S.: For external use.

(2) ℞ Picric acid..... 15 grains;
Vaseline, } each..... 225 "
Lanolin, }
M. S.: For external use.

PIPERIDINE.—Piperidine guaiacolate is described by Dr. Arnold Chaplin and Dr. F. W. Tunnicliffe (*British Medical Journal*, January 16, 1897) as a compound formed by the action of piperidine on guaiacol in a suitable solvent, such as benzol or petrolic ether, having the formula $C_5H_{11}NC_7H_8O_2$, although its exact chemical composition is still under investigation. It crystallizes in prismatic needles or plates. It is soluble to the extent of 3·5 per cent. in water; it is also easily soluble in most organic solvents. It is decomposed into its constituents by mineral acids and alkalies. The chemical property which from a pharmaceutical standpoint is most worthy of note is its relative solubility. When the insolubility of the carbonate of guaiacol is borne in mind this becomes emphasized. The solubility is such that 10 grains may be administered in an ounce draught of simple water, or if the specific gravity of the medium is raised by the addition of a little glycerin or mucilage, a dose of from 20 to 30 grains may be given.

The salt is decomposed into guaiacol and piperidine, probably not in the acid medium of the stomach, but in the alkaline one of the duodenum. The reason for this assumption is that large doses—a drachm—can be given without the slightest eructation of guaiacol. The guaiacol acts in the intestine as an antiseptic; in the structures through which it is excreted, for example, the respiratory mucous membrane, it acts also as an antiseptic. As to the piperidine, its pharmacology forms in part the subject of a research to be published by Dr. Tunnicliffe in conjunction with Dr. Lauder Brunton. For the present, Chaplin and Tunnicliffe simply say that when hydrochloride of piperidine, suitably diluted, is injected into the circulation in doses of 0·05 of a gramme to the kilogramme of weight, the heart is slowed and the vessels are contracted, a considerable rise of blood-pressure taking place. When it is injected under the skin in doses of from 1 to 2 centigrammes to the kilogramme, an increase in reflex excitability occurs, so that if the drug is pushed convulsions may develop. Thus in suitable doses piperidine must be regarded as a cardio-vascular tonic and spinal stimulant.

For three months, the authors say, an inquiry as to the value of piperidine guaiacolate in the treatment of *pulmonary tuberculosis* has been carried out at the City of London Hospital for Diseases of the Chest. The patients to whom the drug was given were subjected to close observation, and the effects of the medicine were from time to time noted. In all, fourteen cases were placed under observation, of which eight were in out-patients and six in in-patients. The duration of the observations varied, but six weeks was about the average. In order to test the value of the drug efficiently, cases were chosen more or less at haphazard, some being early cases in which improvement might be expected under appro-

priate treatment, others being more advanced, while yet others were in such a stage as to make it improbable that much good from any form of treatment would accrue. In all cases the dose to begin with was fixed at 5 grains three times a day, and this was gradually increased until 20, and in one case 25 grains, were given for a dose. So far as could be gathered from questioning the patients and from personal observation, no unpleasant effects were noticed. All of them stated that the medicine had agreed with them. Pains were taken to ascertain if the drug produced any gastric or intestinal irritation, but in no case could it be determined that the processes of digestion were in any way interfered with by it. The authors think this worthy of special stress, because experience has so often taught us that when other derivatives of creosote, such as crude guaiacol, are given over a lengthened period their use has to be discontinued from time to time owing to the gastric and intestinal disturbances caused by them. But in these cases no such untoward event happened.

With regard to the varied symptoms of phthisis, it is difficult to say with certainty, they remark, that the guaiacolate of piperidine had any distinct effect upon them, for in all cases of phthisis it is so frequently found that improved hygienic conditions (good food, rest, and attention), such as a residence in a hospital affords, plays a large part in the restoration of the patient's health. This much, however, they think, may be said, that in many instances the cough appreciably improved while the treatment was in progress. The temperature was in no case affected adversely by the drug; in most cases it receded to normal. The appetite, for the most part, was maintained, and very often patients expressed the belief that the medicine improved it; indeed, in some cases it seemed that it had a decidedly good effect upon the appetite. Some patients gained in weight while the treatment was going on, and in two instances it was thought that more flesh was put on than would have been the case had ordinary remedies been tried. The expectoration in most cases decreased while the drug was being taken. Among the out-patients especially there was a general improvement in strength and vitality. In the case of out-patients it must be remembered, they suggest, that improved hygienic conditions do not come into operation to the advantage of the patient as they do in in-patient practice.

As to the changes noted in the physical signs, it must be admitted, they say, that discussion of this subject is full of difficulty, for it so often happens that, although considerable improvement takes place in the patient's general condition, yet no marked change occurs in the physical signs. Some of the out-patients whose condition was found to be improving were examined week by week to see if any change could be found in the physical signs. Consolidation and excavation were of course unaffected, but in not a few instances the lungs were noticed to become drier with less moist crepitant râles. This change was attributed to the fact that the area of simple inflammation around the tuberculous infiltration itself had passed from an active to a more quiescent condition. The same improvement in physical signs could not be seen in most of the persons under treatment as in-patients. Two out-patients considered that the medicine relieved their dyspnœa, and, to judge from the lung signs, which were under the treatment improving rapidly, it might very well be the case.

Dr. Chaplin and Dr. Tunnicliffe conclude with the following general statements:

1. Experience has shown that piperidine guaiacolate is a perfectly safe drug in doses of from 5 to 30 grains three times a day.
2. It causes no unpleasant effects.
3. It is exceedingly well borne by the stomach, and in this respect it is equal to any other derivative of creosote.
4. Patients while under its influence improve in appetite and general strength.

PYRAMIDONE.—Professor Filehne, of Breslau (*Berliner klinische Wochenschrift*, November 20, 1896; *Therapeutische Wochenschrift*, December 6, 1896), describes this substance as a substitution compound of antipyrine in which an atom of hydrogen is replaced by the group $N\begin{matrix}CH_3\\CH_3\end{matrix}$. It is a white crystalline, tasteless powder soluble in ten parts of water.

The effects of pyramidone on the nervous system are analogous to those of antipyrine throughout, and the mechanism of its *antipyretic* action is the same—that of increasing the dissipation of heat. Thorough observation, however, discloses certain differences of effect. Pyramidone acts on man in doses only a third as large as those of antipyrine: its action is manifested more gradually and subsides more slowly. Its antipyretic action is much milder and lasts longer. Animals poisoned with very large doses of pyramidone show no material alteration of the blood, either microscopically or spectroscopically, and no hæmorrhages, thromboses, or organic degenerations. In the healthy human subject, doses of 8 grains produce neither subjective nor objective effects; doses of from 5 to 8 grains were given to patients three times a day with advantage. The author has always found it promptly efficacious in relieving pain of various sorts, such as *febrile headache, pain in the lymph-glands and the spleen in pseudoleucæmia*, that of *tuberculous peritonitis, anæmia, and multiple neuritis*, and *intercostal neuralgia occurring as a sequel of influenza*. In headache it is sufficient to give 6 grains.

In four cases of nephritis it had no effect on the symptoms, except on the headache in one case of contracted kidney. Its antipyretic action was proved in twelve cases, including those of tuberculosis, typhus, scarlet fever, pseudoleucæmia, influenzal pneumonia, etc. The promptness of its action as an *analgetic* and the mildness of its febrifuge action, the author thinks, entitle it to further trials.

PYROZONE.—Dr. William Cheatham (*Medical Record*, September 12, 1896; *New York Medical Journal*, September 26, 1896)

calls attention to a line of treatment which, he says, has rendered him the best service in two cases of *suppurative otitis media*. In both cases the curette, chromic acid, pyrozone, formalin, boric acid, and many other remedies were employed, but no permanent relief was obtained. Finally Dr. Cheatham directed that 10 drops of a mixture of 10 drops of dilute hydrochloric acid and an ounce of pyrozone should be put into the ear three times a day after cleansing it; the mixture was to be left in for five minutes after having been forced in deep by firm pressure upon the tragus. In the first case a remarkable change was noticed in a few days; in a short time there was no secretion from the cavity, and there has been no return of it for several months. In the second case the patient began to improve rapidly in a few weeks, and recovery set in with no relapse.

Dr. Cheatham states that he has treated several similar cases with but one failure, and that occurred in a tuberculous subject. He has treated many cases of lesser severity with only an occasional failure, and he has not seen this treatment fail in acute cases. Of course in the primary stage of acute cases, he says, such medication is contra-indicated, but after pain, throbbing, and swelling have subsided, and suppuration continues, notwithstanding ordinary treatment, the acid and pyrozone check it very promptly.

As to drainage in these cases, he says, the iodoform or some other of the gauzes cut into narrow strips has given him by far the best results. This treatment is not a cure-all by any means, continues Dr. Cheatham, but he hopes his brief report will lead others to try the acid-and-pyrozone combination. Of course, when the deeper sinuses are involved, surgery is first indicated, then the pyrozone and acid. Under its use, he states, he finds mastoid-cell involvement much less frequent, and he does not believe these effervescing preparations increase such dangers.

QUININE.—Quinine arsenite is a white crystalline powder obtained by dissolving quinine in a hot aqueous solution of arsenous acid. It contains about 69 per cent. of quinine. It is soluble in hot water, slightly so in cold water. It may be used as an *antiperiodic* in doses of from $\frac{1}{4}$ to $\frac{1}{2}$ of a grain.

Quinine dihydrochloride carbamate occurs in colourless crystals easily soluble in water. It contains 70 per cent. of quinine. Its free solubility renders it especially useful for *subcutaneous* employment.

Quinine ferrichloride appears in the market in the form of brown scales or a reddish-brown powder highly hygroscopic. It is freely soluble in alcohol and in water. It has been praised as a *hæmostatic*, used as a dusting powder to be applied over a bleeding area. In a 2-per-cent. solution, its employment in *uterine hæmorrhage* is alleged to have been successful.

Quinine hydrochlorsulphate is obtained by dissolving the hydrochloride and the bisulphate of quinine in warm water in molecular proportions. The solution is evaporated, and the colourless crystals of the double salt appear. It is soluble in an equal quantity of water. It has been recommended for *hypodermic* use.

Quinine salicylate occurs in fine white crystals. It is soluble with difficulty in water. As an *antipyretic* it has been recommended in *typhus fever*, in *gout*, and in *rheumatic conditions*. The dose is from 1 to 8 grains, three times daily.—SAMUEL M. BRICKNER.

RÖNTGEN RAYS.—See X-RAYS.

SALICYLIC ACID AND THE SALICYLATES.—*Thiersch's solution* contains 1 part of salicylic acid and 6 parts of boric acid, dissolved in 500 parts of hot water. It is a bland, harmless antiseptic, and may be freely used on surfaces and in areas where more vigorous antiseptic fluids might be absorbed and produce poisoning. The peritonæum and pleura are especially adapted to its employment.

Aluminum and ammonium salicylate, aluminum salicylate.—See SALUMINE.

Bismuth and cerium salicylate is an insoluble pink powder. It has been recommended in *acute diseases of the gastro-intestinal tract* in doses of from 15 to 30 grains.

Caffeine and sodium salicylate, or *caffeine and sodium cinnamate*, is a freely soluble double salt, well adapted for *hypodermic* use.

Camphor salicylate is a crystalline preparation employed in the treatment of *lupus* and *parasitic skin diseases*. Internally, it has been recommended in doses of from $3\frac{1}{2}$ to 5 grains for the relief of *chronic dysentery* and *chronic diarrhœa*.

Chlorosalol is the chlorophenylic ether of salicylic acid. Its indications and dose have not yet been determined.

Cresalol, cresol salicylate is the cresalol analogue of betol and salol, for which it is sometimes employed. In the system they are split up into cresol and salicylic acid.

Dithiochlorosalicylic acid appears as a reddish-yellow powder. It is reputed to have an antiseptic influence.

Quinine salicylate.—See under QUININE (Supplement).

Sodium sulphosalicylate, a white crystalline powder, with no special advantages, has been proposed as a substitute for sodium salicylate.

Sulphosalicylic acid, or **salicylsulphuric acid,** is obtained from the action of fuming sulphuric acid on salicylic acid. White crystals, soluble in water and in alcohol, are the result. Albumoses and peptones will be precipitated on the addition of this salt to a solution containing them, but will be redissolved on boiling, while albumins and globulins, if present, will remain precipitated. The salt is therefore a valuable testing agent.

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SALUBROL.—This is a new substitute for iodoform described by Dr. M. Silber, of Breslau (*Deutsche medicinische Wochenschrift*, December 24, 1896; *Therapeutische Wochenschrift*, January 3, 1897), as made by the action of bromine on a compound of methylene and antipyrine. It is stable under ordinary circumstances, but on coming in contact with organic matter it gradually gives off bromine. The powder applied to the skin sometimes gives rise to a burning pain, but a 20-per-cent. gauze has no irritating action. Salubrol has been given to animals subcutaneously in daily amounts of 150 grains without their manifesting any poisonous action.

SALUFER, according to Dr. Squibb (*Ephemeris*, January, 1897), is the trade name given by a manufacturer in Leeds, England, to potassium silicofluoride. It is reported to be an efficient *antiseptic* and *deodorizer*, but the chief applications in which it has made its record are in *chronic otorrhœa* and as a uterine wash in *puerperal fever*. It readily dissolves in water, and a saturated solution may be made in boiling water. It is non-toxic, but stains instruments. Often the best effects are to be obtained from the saturated solution.

Mr. F. Faulder White, F. R. C. S., of Coventry, England, reports having even freely dusted very *foul wounds* with the powder, rapidly washing it off. Recovery takes place without local inflammation or rise of temperature.

Nothing has been heard of it in America as yet.

SALVIA.—Krahn (cited in *Fortschritte der Medicin*, November 15, 1896) gives a *résumé* of the literature of salvia, and says that he has used it in thirty-eight cases of *profuse sweating*, mostly in tuberculous persons. He employs a tincture made with 1 part of the leaves and 10 parts of alcohol, and he has convinced himself of its harmlessness by taking as much as 40 drops of it twice a day for six weeks. He has generally given his patients 20 drops in the morning and from 20 to 40 drops in the evening. For dispensary patients he orders an infusion made with a tablespoonful of the leaves and a pint of water, of which they take a cupful night and morning. In all but two of the thirty-eight cases it acted favourably, but the action was not sustained when it was given for weeks at a time. Fever, he says, is not a contra-indication, and he has observed no unpleasant effects.

SENECIO.—Mr. W. E. Fothergill (*Medical Chronicle*, November, 1896; *New York Medical Journal*, December 19, 1896) has summarized the work of Dr. William Murrell, Dr. Dalché, Dr. Heim, Dr. Bardet, and Dr. Bolognesi bearing on the therapeutic value of the senecios, and their conclusions, substantially as follows:

Murrell, among other remarks, says he has found that it acts admirably in those cases of *amenorrhœa* in which the menstrual function, having been established and performed regularly for some months or even years, is delayed or suspended as the result of exposure to cold or some similar cause. In cases in which the amenorrhœa is associated with or dependent on anæmia, senecio uniformly failed to do any good until the anæmic condition had been removed with iron. In cases in which the menstrual flow had never been established, senecio was frequently most useful, and in four cases of *vicarious menstruation*—the blood coming from the mouth or gums—nothing could have been more satisfactory. He is satisfied that senecio not only anticipates the period, but also increases the quantity of the flow. In many cases of *dysmenorrhœa* it promptly relieves the pain, and not infrequently the *menstrual headache* from which many women suffer. Senecio is apparently not an ecbolic.

Dalché and Heim conclude that the drug relieves painful menstruation if the reproductive organs are healthy, but not otherwise. They remain doubtful whether senecio provokes the menstrual flow, and they offer no hypothesis as to its mode of action.

Bardet and Bolognesi conclude that senecio has the constant property of provoking menstruation, though administered in small and harmless doses. They hold that it always tends to regulate menstruation, but that it does not relieve pain at the periods, and does not increase the quantity of the discharge. They suggest that it both produces congestion of the reproductive organs and also excites contraction of the uterine muscle.

M. Bardet mentioned one of the cases on which the latter supposition is based in a discussion at the Société de thérapeutique. A woman, aged thirty-eight years, suffered from nausea and hypogastric sensations recalling to the mind those of pregnancy, on three occasions after she had taken senecio. But subjective phenomena described by a patient, says the writer, are very slight evidence on which to base a statement, as M. Bardet does, to the effect that her uterus contracted.

M. Blondel thinks that the reports on the physiological action of senecio are both vague and contradictory, and that until the action of a drug is definitely known its indications and contra-indications can not be established. Amenorrhœa, he says, is not a disease but a symptom; its causes must be discovered before they can be attacked, and the treatment should always be indirect, on account of the risk of causing abortion. The drugs which act directly in provoking menstruation, he thinks, are unreliable, dangerous, and of merely temporary effect.

Now, these remarks of M. Blondel, continues Mr. Fothergill, though likely to catch the sympathy of the superficial reader, are not really calculated to deter any one from giving respectful study to the work of these authors. For, to go over his objections in reverse order, granting that the so-called emmenagogues in use are unsatisfactory, there is no reason *a priori* why it should not be discovered that one or other of the active principles of the senecios is a true emmenagogue, reliable, safe, and perhaps even permanent in its action. Next, in certain cases, amenorrhœa is not a symptom of any pre-existent disease, but is

due to the action on the nervous system of various external and temporary causes. Secondary bad effects, both mental and physical, follow the amenorrhœa, which in such cases is a primary disorder, and is certainly one suitable for direct treatment. Thus, Edelheit mentions four cases in which amenorrhœa inaugurated a primary and serious affection, fatal in two of them, recovery in the other two following the re-establishment of menstruation. Again, the difficulties in diagnosticating early pregnancy, if great, are not insuperable to all; and there is no necessity for any one to administer a possible ecbolic while still in doubt as to the diagnosis. Lastly, if no drug may be used until its action is definitely known and its indications are clearly defined, there is an end to the introduction of new therapeutic agents. All that the most exacting can demand is that the introducer of a new drug shall give a working hypothesis according to which the drug may reasonably be supposed to act.

Menstruation, he continues, expresses an anabolic surplus produced by the healthy human female from puberty to the menopause, except during pregnancy and lactation, the time of its occurrence probably being determined by the activity of a special centre in the lumbar part of the cord. In the light of this view of menstruation, he says, substances like iron, which affect the quality or quantity of the blood, are only indirectly emmenagogues. In like manner, substances which, by causing renal or gastro-intestinal irritation, promote pelvic congestion and uterine hæmorrhage, are also indirect in their emmenagogue action. To be a direct emmenagogue, a substance must act upon the nervous mechanism which initiates the discharge—namely, the hypothetical centre for menstruation. Thus an emmenagogue is quite distinct from an ecbolic, which is supposed to cause contraction of the uterine muscle by acting either on the fibres themselves or on their motor nerves. It is possible, he thinks, that senecio may be found to contain an active principle which is a direct emmenagogue in the proper sense of the word, and it does not follow that this principle must be an ecbolic.

Several kinds of amenorrhœa, continues Mr. Fothergill, may be classified according to treatment, and the indications defined by the use of the direct emmenagogue which senecio may prove to be. From the reports of these authors, it does not seem likely that the drug will be of much use in dysmenorrhœa. The following is his classification according to treatment:

No Treatment.—Physiological amenorrhœa —*i. e.*, before puberty, during pregnancy, during lactation, and after the menopause. Amenorrhœa due to congenital or acquired deficiency or to absence of essential reproductive organs.

Surgical and other Local Treatment.—Amenorrhœa due to local defects, such as atresia vaginæ, atresia cervicis uteri, congenital or acquired neoplasms, etc.

Indirect Treatment.—Amenorrhœa due to general disease which so disturbs metabolism that there is no anabolic surplus—*e. g.*, anæmia and phthisis—where menstruation would be an unnecessary drain on the patient.

Direct Treatment by Emmenagogues.—Amenorrhœa due to want of activity of the nervous mechanism initiating menstruation, caused by nervous disease, shock (mental or physical), fear or hope of pregnancy, etc., including those cases in which the function has never been established, but where there is no local defect or general disease sufficient to account for its absence.

SILVER.—Dr. R. Abrahams, of the Mt. Sinai Hospital, New York (*Journal of the American Medical Association*, January 30, 1897), writes in praise of the action of *silver nitrate* in a number of morbid conditions. One of these is the epidermal callosity commonly known as a *corn*. Soak the corn in hot soapy water, he says, then shave down the horny layers, and apply a 30-per-cent. solution of silver nitrate. The corn will never, or hardly ever, recur after the silver has been applied to it.

Certain forms of *lupus vulgaris*, says Dr. Abrahams, are eminently adapted to the local application of nitrate of silver. The first indication is found in the small lupus papules which characterize the beginning of the destructive disease. By effectively cauterizing the primary lesions the disease will be prevented from taking root. The second indication is suggested by the lupus nodules which are formed by the coalescence of the initial papules. Lupus in both these forms, he says, can be radically cured by the thorough application of silver caustic. The third indication is the serpiginous form of lupus. Here silver is used as a means only to stop the downward march of destruction. Kaposi thus speaks of silver in the treatment of lupus vulgaris: "Apart from mechanical treatment, the use of caustic is important. The most practicable is solid nitrate of silver. It has sufficient resistance to penetrate the individual lupus nodules, thus uniting mechanical and caustic action. It also possesses the advantage that it does not enter healthy tissues. Large nodules of lupus tumidus, and particularly superficial infiltrations, may be burned out as thoroughly as with the sharp spoon. Since the solid stick not only destroys the vessels of the border and base mechanically, but also causes thrombosis, the cauterization furnishes all the requirements for effecting a cure." In the face of this eminently authoritative statement, says Dr. Abrahams, it is hard to see why some writers of distinction fail to include this agent among the local remedies for lupus.

Lunar caustic finds a fitting place in suitable cases of *epithelioma of the skin* and *mucous membranes*, says Dr. Abrahams. Generally speaking, he says, the method of applying the caustic in cutaneous cancers is the same as in lupus or in the other growths above mentioned, but the indications are fewer. As in lupus, when the cancerous nodule or ulcer is small, nitrate of silver is an effective and curative remedy. It is also indicated in "inoperable" cases, in recurrent nodules, and in the serpiginous forms of epithelioma.

SODIUM SULPHOSALICYLATE.—See under SALICYLIC ACID AND THE SALICYLATES (Supplement).

SUGAR.—For the use of sugar in scorpion stings, see under HONEY (Supplement).

VACCINIUM.—Dr. Karl Ullmann (*Wiener medizinische Wochenschrift*, 1895, No. 41; *Monatshefte für praktische Dermatologie*, June, 1896) relates his experience in the use of Winternitz's *myrtillin* (an inspissated extract of *Vaccinium Myrtillus*) in a hundred cases of skin diseases in Hans Hebra's clinic. The extract is applied to the affected skin in a thick layer, over this a thin coat of cotton is laid, and the part is bandaged. The diseased part is cleansed daily with a 1-to-200 solution of sodium chloride and with alcohol or French brandy.

Seventy of the cases were of eczema; the others included various itching affections, hyperkeratoses, psoriasis, local formations of wheals, and burns to the degree of rubefaction or of vesication. The cases of *eczema* were chiefly those of occupation-eczema, the next most numerous were those of mycotic eczema, and finally came those of idiopathic and artificial eczema. In the matter of a cure the results were not so good as had been expected.

In the cases of *occupation-eczema*, especially where there was much scaling, there was transient improvement, but in the weeping, vesicular, and pustular forms there was not. The effect was better, however, in cases of eczema of the fingers and feet characterized by the formation of wheals and rhagades.

Mycotic eczema was improved, and the scaling seemed to subside, but in no instance was there an actual cure. There was no good effect in cases of intertrigo and eczema of the scrotum. In cases of *mycosis flexurarum*, especially if there was much scaling and thickening of the skin, a better effect was produced. The remedy acted well in *seborrhœal eczema of the face* in children, but not so well in the seborrhœa of adults. It had no effect, or only the most transitory one, in acute idiopathic eczema, acute dermatitides, so-called trophic eczema, and psoriasis. In three instances *burns* to the degree of rubefaction or vesication were quickly cured with it. It was used in the following compounds:

(1) Purified extract of the berries of *Vaccinium Myrtillus*..... 50 parts;
Epidermin..... 10 to 15 "

(2) Purified extract of the berries of *Vaccinium Myrtillus*..... 50 parts;
Myrrh..... 2 "

The author comes to the following conclusions: Extract of myrtillus is no specific against eczema. It is of advantage only in redness, scaling, and wheallike thickening in consequence of chronic eczema affecting the hairless parts of the body and in the seborrhœal eczema of children. Mycotic and itching affections of the skin are hardly influenced by it or only in a very transitory way. Wheals and chronic inflammatory infiltrations are softened by it. In burns of the first or second degree its action is remarkably quick and satisfactory. The active principle of the extract is probably a material containing tannic acid, and it possesses pronounced antizymotic properties. The extract is astringent and keratoplastic. It is in no wise irritating or poisonous.

X RAYS.—M. Rendu (*Progrès médical*, January 30, 1897) relates the case of a lad, twenty years old, who presented all the symptoms of infectious *pneumonia*, although a bacteriologist professed to have found Koch's bacilli in the sputa. The patient's father asked that the Röntgen rays be used in the treatment. Daily applications of fifty-five minutes' duration were begun, and after the third application a very distinct amelioration was manifest. The fever fell, there was natural perspiration, and there was a very abundant diuresis. After the first application there was produced on the skin where the rays had penetrated an intense erythema which was followed by blisters, then an eschar which did not heal for several weeks. M. Rendu questions whether recovery was the result of the acute revulsion produced by the erythema, or the result of the action of the X rays on microbes. He thinks that the patient was not tuberculous.

The idea has recently been entertained that the Röntgen rays may be of service in *tuberculosis*. In the *Fortschritte der Medicin* for February 1, 1897, there is an abstract of an account, published in the *Semaine médicale*, of some experiments undertaken by M. Lortet and M. Genoud nearly a year before. On April 23, 1896, eight Guinea-pigs were inoculated in the fold of the right groin with bouillon that had been infected with a Guinea-pig's tuberculous spleen. Two days later three of the animals were stretched out on a board and the inoculated region was exposed to the influence of the Röntgen rays. This was done daily for about an hour for fifty-three days. On the 9th of June the five check animals were observed to have spontaneous abscesses, and their inguinal glands of the affected side were softened. On the other hand, the three that were under treatment with the Röntgen rays had no abscesses and their inguinal glands were firm and sharply defined. Nine days later the five check animals showed abundant suppuration in the inguinal fold or on the thigh, and they had manifestly grown thin. The three that were under treatment were in good condition and had gained in weight; their inguinal glands were small, having gradually shrunk, and showed no tendency to suppuration. The Röntgen rays, therefore, are held to have prevented the acute development of tuberculosis in this instance. The authors suggest the therapeutical employment of them in cases of tuberculous disease of the thoracic and abdominal organs, especially in children.

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Sodium phosphate, ii, 208.
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Arsenic, i, 146.
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Air, inspiration of condensed, i, 28.
Alum whey, i, 50.
Ammonium carbonate (as an expectorant), i, 55, 56.

Bronchitis, chronic.
Ammonium chloride, i, 418.
Apomorphine, i, 139.
Arsenic, i, 146.
Benzene, i, 176.
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Calcium carbide, ii, 426.
Chromic acid, i, 248.
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Calcium sulphide, i, 203.
Carbolic acid (parenchymatous injections), i, 213.
Iodol, i, 540.
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Salol, camphorated, ii, 150.
Sodium phosphate, ii, 208.
Turpentine liniment, ii, 336.
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Air, condensed, inspiration of, i, 28.
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Aluminum borotannicotartrate, ii, 414.
Ammonium hydrosulphide, i, 57.
Anthemis inhalations, i, 231.
Arsenic, i, 146.
Balsamic fumes, i, 259.
Baths, condensed-air, i, 27.
" sulphur, i, 173.
Bismuth powder, i, 181.
Boric acid (saturated solution), i, 191.
Bromine vapour, i, 196.
Cantharides, i, 346.
Carbonic-acid inhalation, ii, 430.
Cimicifuga, i, 250.
Copaiba, i, 445.
Copper-arsenite solution, i, 303.
Coto bark, i, 309.
Cubeb, i, 319.
" cigarettes, i, 43.
Eucalyptol, i, 402.
Europhene (by insufflation), i, 402.
Formaldehyde, i, 428.
Geosite, ii, 438.
Ginger troches, i, 449.
Guaiacol, i, 457.
Hydrastis, i, 475.
Ipecac, i, 542.
Licorice, i, 580.
Menthol solution (by injection), i, 614.
Nucleins, ii, 24.
Orexine hydrochloride, ii, 457.
Oxygenated water and hydrogen-dioxide solution (by inhalation), ii, 52.
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Pulsatilla, ii, 107.
Quinine, i, 255.
Salol, ii, 150.
Salumine, ii, 152.
Sanguinaria, ii, 154.
Sesame oil, ii, 190.
Silver nitrate, ii, 194.
Sodium chloride, ii, 206.

Catarrh.
Sodium sozoiodolate, ii, 208.
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Steam, i, 418.
Tannal, ii, 254.
Tannalbin, ii, 254.
Tanosal, ii, 261.
Tartar emetic, i, 114.
Turpentine, i, 345.
Water, i, 479.
Waters, alkaline, i, 45.
" mineral, ii, 375, 384.
" sodium sulphate, ii, 368.
" thermal, ii, 364.
Wine, ii, 394.
" port, ii, 393.
Xeroform (internally), ii, 397.
Zinc salicylate, ii, 410.
" sulphichthyolate, ii, 412.

Catarrh, acute.
Ammonium acetate, i, 54.
Baths, condensed-air, i, 27.
Pulsatilla, ii, 107.

Catarrh, acute nasal.
Bismuth powder (used as a snuff), i, 181.
Copper-arsenite solution (in form of a spray), i, 303.
Cubeb, i, 319.

Catarrh, apical.
Air, condensed, inspiration of, i, 28.

Catarrh, atrophic pharyngeal.
Coto bark, i, 309.

Catarrh, bronchial.
Apomorphine (as an expectorant), i, 139.
Baths, condensed-air, i, 27.
Cimicifuga, i, 250.
Cubeb cigarettes, i, 430.
Ipecac, i, 542.
Licorice, i, 580.
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Catarrh, chronic.
Ammonium chloride, i, 528.
Copper-arsenite solution (in form of a spray), i, 303.
Dulcamara, i, 353.
Myrtol, i, 652.
Zinc sulphichthyolate, ii, 412.

Catarrh, chronic bronchial.
Iodol (by insufflation), i, 540.

Catarrh, chronic duodenal.
Waters, mineral, ii, 384.

Catarrh, chronic gastric.
Arsenic, i, 146.
Hydrastis, i, 475.
Oxygenated water and hydrogen-dioxide solution (by inhalation), ii, 52.
Quinine, i, 255.
Silver nitrate, ii, 194.

Catarrh, chronic gastroduodenal.
Alkaline mineral waters, i, 45.

Catarrh, chronic intestinal.
Ammonium borate, i, 55.
Sesame oil, ii, 190.
Tannalbin, ii, 254.
Waters, sodium-sulphate, ii, 368.

Catarrh, chronic nasal.
Ammonium chloride, i, 528.

Catarrh, chronic, of the bladder.
Pulsatilla, ii, 107.

Catarrh, chronic, of the gastro-intestinal and genito-urinary tracts.
Guaiacol, i, 457.

Catarrh, chronic, of the middle ear.
Massage, i, 610.

Catarrh, chronic, of the rectum.
Cubeb, i, 319.
Menthol inhalation, i, 529.
Ozone inhalation, ii, 58.
Sanguinaria, ii, 154.
Waters, chlorinated alkaline, ii, 381.
" " " (externally and internally), ii, 381.
Waters, thermal, ii, 364.

Catarrh, dry, of the nose and pharynx.
Salumine (by insufflation), ii, 152.

Catarrh, gastric.
Eucalyptol, i, 400.
Hamamelis, i, 467.
Nux vomica, ii, 28.
Papain, ii, 60.
Salicylic acid, ii, 143.
Sesame oil, ii, 190.
Waters, chlorinated, ii, 366.
" mineral, ii, 375.

Catarrh, gastro-duodenal.
Sanguinaria, ii, 154.
Sodium phosphate, ii, 208.

Catarrh, gastro-intestinal.
Water, i, 479.

Catarrh, hepatic.
Salol, ii, 150.

Catarrh, intestinal.
Eucalyptol, i, 400.
Grape cure, i, 455.
Oxygenated water and hydrogen-dioxide solution (locally through the stomach-tube), ii, 52.
Pulsatilla, ii, 107.
Salol, ii, 150.
Waters, mineral, ii, 375.
Wine, ii, 394.
Xeroform (internally), ii, 397.

Catarrh, laryngeal.
Balsamic fumes, i, 529.
Baths, condensed-air, i, 27.

Catarrh, nasal.
Boric acid (saturated solution), i, 191.
Bromine vapour, i, 196.
Carbolic-acid solution (by spray), i, 213.
Menthol solution (by injection), i, 614.
Sodium chloride (as a gargle), ii, 206.
" sozoiodolate, ii, 208.
Zinc salicylate, ii, 410.

Catarrh, naso-pharyngeal.
Nucleins, ii, 24.

Catarrh of the air-passages.
Steam, i, 418.

Catarrh of the bile ducts.
Salol, ii, 150.
Silver nitrate, ii, 194.
Waters, mineral, ii, 384.

Catarrh of the bladder.
Solanum paniculatum, ii, 210.
Tannin injections, ii, 256.

Catarrh of the digestive tract.
Arsenic, i, 146.
Cubeb, i, 319.

Catarrh of the digestive tract.
Eucalyptol, i, 400.
Geosite, ii, 438.
Guaiacol, i, 457.
Hydrastis, i, 475.
Orexine hydrochloride, ii, 451.
Oxygenated water and hydrogen-dioxide solution (by inhalation), ii, 52.
Quinine, i, 255.
Salol, ii, 150.
Sanguinaria, ii, 154.
Sesame oil, ii, 190.
Silver nitrate, ii, 194.
Tannalbin, ii, 254.
Water, i, 479.
Waters, alkaline, i, 45.
" mineral, ii, 384.
" sodium sulphate, ii, 368.
Wine, ii, 394.
Xeroform, ii, 397.
Catarrh of the gall bladder and ducts.
Waters, sodium-sulphate, ii, 368.
Catarrh of the genito-urinary tract.
Bismuth, i, 181.
Cantharides, i, 345.
Formaldehyde, i, 428.
Guaiacol, i, 457.
Pulsatilla, ii, 107.
Solanum pulsatilla, ii, 210.
Turpentine, i, 345.
Waters, thermal, ii, 364.
Catarrh of the respiratory tract.
Air, condensed, inspiration of, i, 28.
Anthemis inhalations, i, 231.
Apomorphine (as an expectorant), i, 139.
Asclepias tuberosa, i, 148.
Balsamic fumes, i, 259.
Baths, condensed-air, i, 27.
Bismuth powder, i, 181.
Boric acid (saturated solution), i, 191.
Bromine vapour, i, 196.
Carbonic-acid inhalation, ii, 430.
Cimicifuga, i, 250.
Copper-arsenite solution, i, 303.
Coto bark, i, 309.
Cubeb cigarettes, i, 43.
Ginger troches, i, 449.
Ipecac, i, 542.
Licorice, i, 580.
Menthol solution (by injection), i, 614.
Nucleins, ii, 24.
Salumine (by insufflation), ii, 152.
Sodium chloride, ii, 206.
" sozoiodolate, ii, 208.
Steam, i, 418.
Tanosal, ii, 261.
Tartar emetic, i, 114.
Waters, chlorinated, ii, 366, 367.
Zinc salicylate, ii, 410.
" sulphichthyolate, ii, 412.
Catarrh of the throat and bronchi.
Tanosal, ii, 261.
Catarrh of the throat and mouth.
Ginger, troches of, i, 449.
Catarrh of the upper air-passages.
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Formaldehyde, i, 428.
Catarrh of the vagina and cervix uteri.
Iodol, i, 540.
Rosinal, ii, 135.
Catarrh, pharyngeal.
Baths, condensed-air, i, 27.
Catarrh, pulmonary.
Balsamic fumes, i, 529.
Catarrh, respiratory.
Chamomile, i, 231.
Podophyllin, ii, 93.
Catarrh, subacute intestinal.
Tannalbin, ii, 254.
Catarrh, subacute nasal.
Baths, condensed-air, i, 27.
Catarrh, uterine.
Douche, hot, i, 480.
Grindelia, i, 456.
Rosinal, ii, 135.
Catarrh, vaginal.
Formaldehyde, i, 428.
Iodol, i, 540.
Rosinal, ii, 135.
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Thyreoid treatment, ii, 299.
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Arnica, fluid extract of (internally), i, 141.
Baths, hot sitz, i, 169.
Electricity, i, 368.
Glycerin suppositories, ii, 450.
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Ice applications, i, 520.
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